SCIENTIFIC AMERICAN

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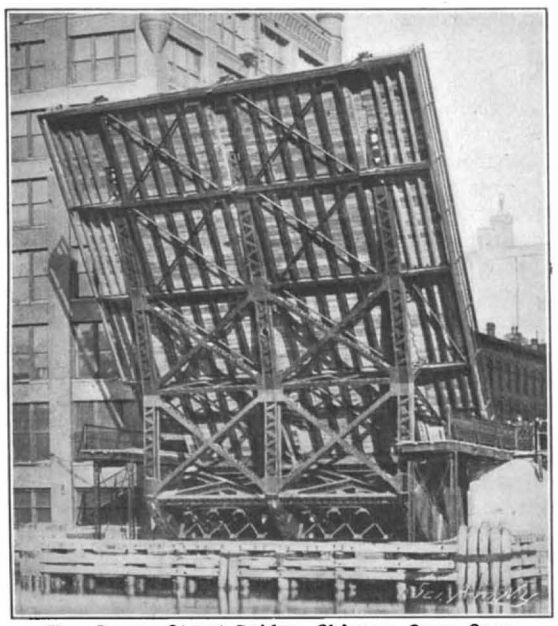
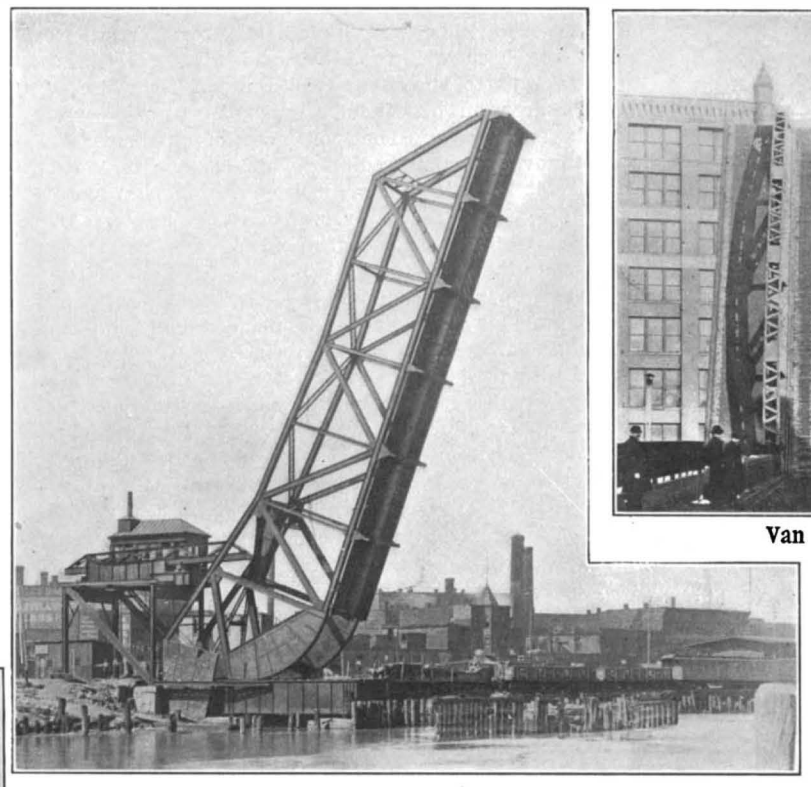
A WEEKLY JOURNAL OF PRACTICAL INFORMATION, ART, SCIENCE, MECHANICS, CHEMISTRY, AND MANUFACTURES.

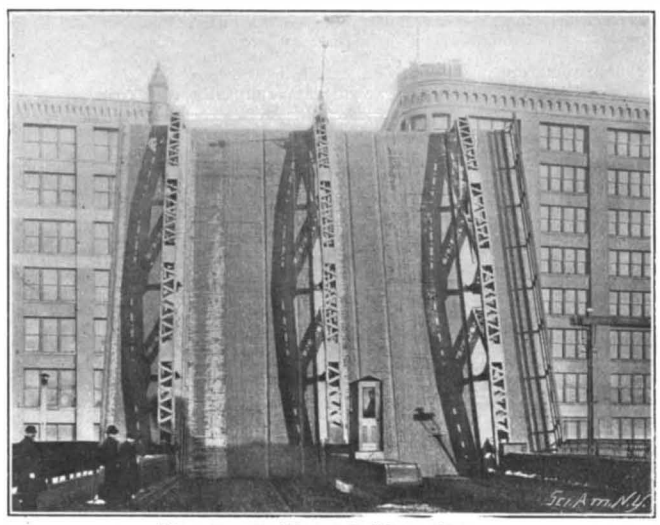
Vol. LXXXV.—No. 13. ESTABLISHED 1845. NEW YORK, SEPTEMBER 28, 1901. $3.00 A YEAR. 8 CENTS A COPY.



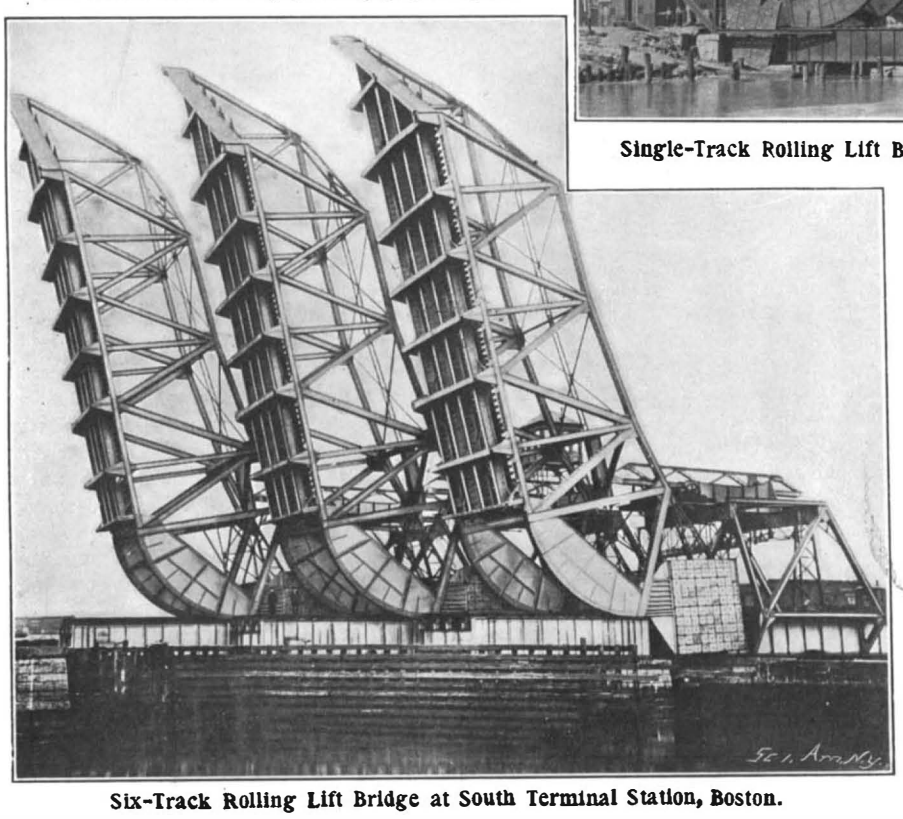
Van Buren Street Bridge, Chicago, Span Open.



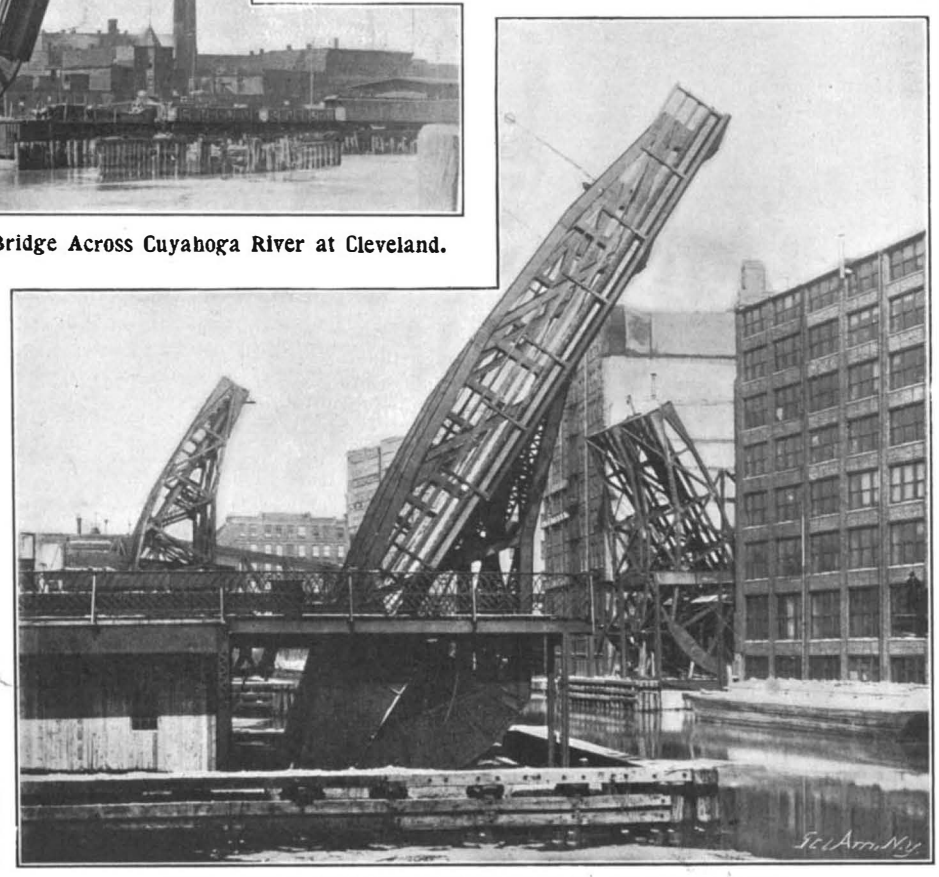
Single-Track Rolling Lift Bridge Across Cuyahoga River at Cleveland.



Van Buren Street Bridge, Chicago.



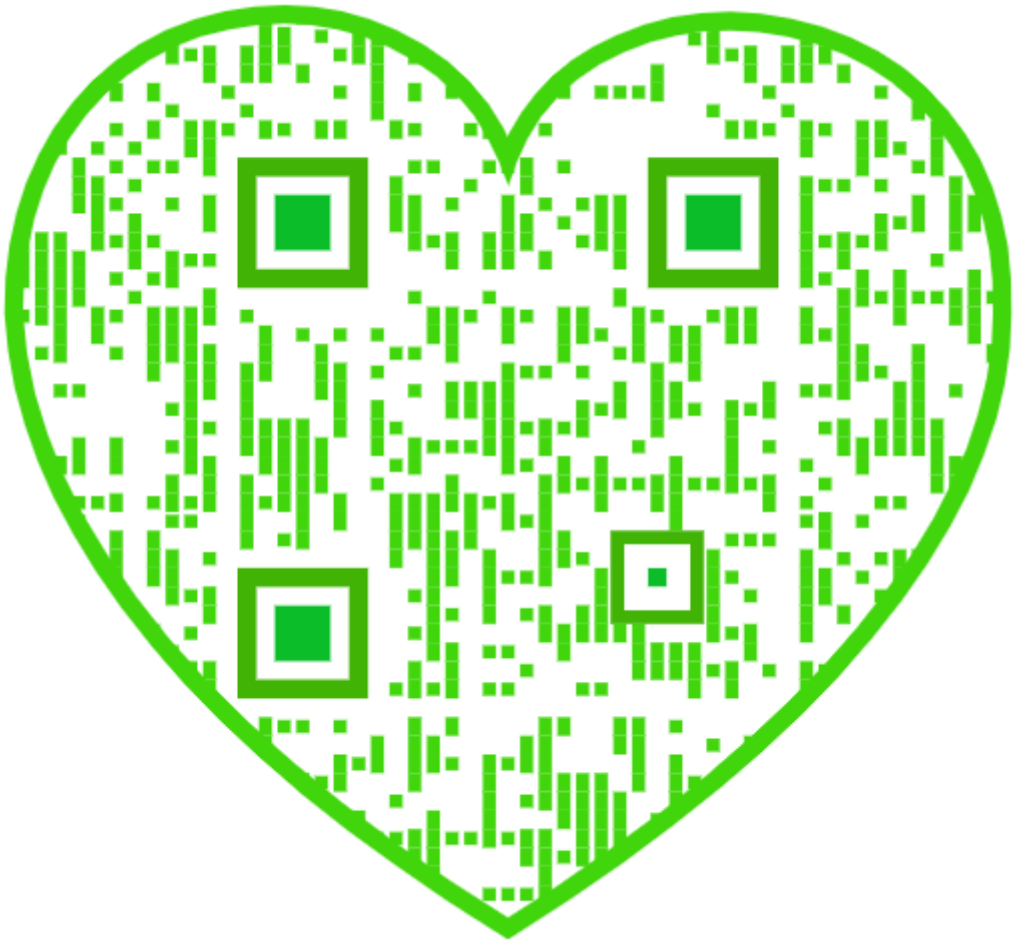
Six-Track Rolling Lift Bridge at South Terminal Station, Boston.



Rolling Lift Bridge Over Chicago River at Van Buren Street.

Electrically Operated Highway Bridge Across the Chicago River at North Halsted Street, Chicago.

ROLLING LIFT BRIDGES.—[See page 198.]



Scientific American.

ESTABLISHED 1845

MUNN & CO., - - - EDITORS AND PROPRIETORS.

PUBLISHED WEEKLY AT

No. 361 BROADWAY, - - NEW YORK.

TERMS TO SUBSCRIBERS

One copy, one year, for the United States, Canada, or Mexico $3.00
One copy, one year, to any foreign country, postage prepaid. £0 16s. 5d. 4.00

THE SCIENTIFIC AMERICAN PUBLICATIONS.

Scientific American (Established 1845).....$3.00 a year
Scientific American Supplement (Established 1876) ..... 5.00 "
Scientific American Building Edition (Established 1885). ..... 2.50 "
Scientific American Export Edition (Established 1878)..... 3.00 "

The combined subscription rates and rates to foreign countries will be furnished upon application.

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MUNN & CO., 361 Broadway, corner Franklin Street, New York.

NEW YORK, SATURDAY, SEPTEMBER 28, 1901.

The Editor is always glad to receive for examination illustrated articles on subjects of timely interest. If the photographs are *sharp*, the articles *short*, and the facts *authentic*, the contributions will receive special attention. Accepted articles will be paid for at regular space rates.

PEARY'S ARCTIC DISCOVERIES.

The greatest credit is due to that indomitable explorer, Lieutenant Peary, for his latest work in defining the geography of the Arctic regions. Although he has not as yet succeeded in reaching the North Pole, or, indeed, in traveling as far north as did Nansen and Abruzzi, he has made a contribution to our knowledge of the Arctic regions which, in extent and usefulness, compares favorably with the work of any previous explorers, and may be regarded as an ample return for the risks and labors of his long season of exploration. As a result of his work around the northern coast of Greenland, the geographical boundaries of the great island of the northern hemisphere are now defined with scientific accuracy. The only break in the coast line consists of a short length of unsurveyed land between Independence Bay—so named by Peary at the time of its discovery, nine years ago—and Cape Bismarck, on the east coast of Greenland. Thus the explorations of Greenland, which have been in progress now for a thousand years past, are practically completed by Peary's arduous labors and thoroughly scientific methods. His work, stated in detail, consists of surveying that portion of the coast line of Melville Bay on the west of Greenland; a survey of the entire northwestern, north and northeastern coast as far south as Independence Bay; and the accurate mapping out of the channel which extends through Smith's Sound to the Arctic Ocean on the north coast of Greenland. Peary has also traveled 2,400 miles on the great inland ice cap, and has located its extreme northern limits; twice he has crossed Grinnell Land; and he has also given us an accurate location of its western shore to a point considerably south of existing surveys. It is true that other explorers have traveled further north than he; but their work, although of great scientific interest, and carrying perhaps more of the elements of the spectacular, has not given to the world such a considerable increase in its geographical knowledge as results from Peary's latest travels.

Peary has also done great service to Arctic exploration by proving that his theories as to the best method of traveling are correct. He set out on this last trip with the conviction that, if the North Pole is ever to be reached, it must be done with the co-operation of the natives and with the extensive use of dogs and sledges. In his recent work he has given practical proof of the soundness of his theories. Early in the next spring it is his purpose to make a final "dash for the North Pole" which, if successful, will add greatly to his well-earned fame. Should he succeed in reaching it, he will confer a double benefit upon Arctic exploration, since he will at once settle a greatly overrated, but much-considered question, and by so doing will divert the energy of subsequent explorers to the more useful work of mapping out the undiscovered regions within the Arctic circle and rounding out to completeness our geographical knowledge of the northern hemisphere.

"COLUMBIA" AND "SHAMROCK."

Now that we are on the eve of another of those great contests which stir so deeply the yachting and marine world, a comparison of "Columbia" and "Shamrock" in respect to their construction and past performances is of undoubted interest. In the first place, it is certain that never before have the English and American boats been so similar in size, model, materials, or spread of sail—never, indeed, if we may venture a forecast, have they been so equally matched in speed. In both yachts the framing of the hull consists of nickel steel, and the plating of a bronze alloy of great ductility and tensile strength, Tobin bronze being used in the "Columbia" and immadium in the "Shamrock." Neither boat will have much advantage in this respect, the strength for weight, and the degree of polish of the underbody being about the same. In the above-water portion of the hulls "Shamrock" must be considerably lighter, for her freeboard is, on an average, some six inches lower and hence 80 feet of plating and framing is saved. Moreover, the weight of the deck is less, the "Shamrock" being decked with thin steel plating and the "Columbia" with wood. The lower freeboard and lighter deck of "Shamrock" may account to a certain extent for the unexpected ease with which she carries her exceptionally lofty rig.

Compared as to sailplan and rig, the advantage in weight probably lies with "Columbia;" for Herreshoff has always been well in advance of his competitors in his ability to spread and hold up to its work a big sail area on a wonderfully light set of spars, shrouds and stays. The pole-mast of "Shamrock" is an innovation, the credit of which is due to Watson; and it is undoubtedly, in proportion to its great length (158 feet 6 inches over all), a very light piece of work. It is the next logical advance in construction upon the telescoping topmast first used by Herreshoff upon "Columbia" in 1899. At the same time it probably weighs more in place than the mast of "Columbia." It is not less than 11 feet longer over all; and the saving in weight at the hounds is offset by the fact that "Columbia" is using the hollow wooden topmast which was built for "Constitution." The standing and running gear on "Shamrock" is somewhat heavier, as it must needs be, to hold her lofty sailspread up to its work. Both yachts have hollow steel boom, gaff, and topsail spars. The boom of the "Columbia" being trussed, must be, we presume, somewhat the lighter of the two.

It is generally believed that "Shamrock" carries so large a sailspread that she will have to make a heavy time allowance to "Columbia," as large, if not larger than that given by "Constitution." This expectation is based upon the mistaken idea that the base of the triangle for sail area measurement in "Shamrock" is proportionately as great as the perpendicular. As a matter of fact it is a relatively short base, and as much under the normal as the perpendicular is above it. The boom of the "Shamrock," which has been erroneously given as anywhere from 110 to 120 feet in length, in reality measures exactly 102 feet 9 inches over all, as against 107 feet, the length of "Columbia's" boom. When the tape-line of the official measurer comes to be laid over the yachts it will be found that the distance from end of boom to forward point of measurement is less than 183 feet in "Shamrock," or only two feet more than that of "Columbia" when she met the first "Shamrock" in 1899.

The short boom and lofty rig on the challenger show the lessons taught by the racing experience of the past few years, one of the most important of which is that the exaggerated length of the main boom on modern cutters is a mistake, the mainsail becoming too long on the foot for the best effect in driving the yacht to windward. The first hint of this came when the rig of the German Emperor's "Meteor" was changed from the cutter to the yawl type, the yacht showing a marked improvement under her reduced sail area. Further evidence to the same effect was forthcoming in "Shamrock I."; for much of the improvement seen in that yacht this year is due to a reduced mainsail, her present boom being several feet shorter than the one used in 1899.

A comparison of the models of the two yachts shows a marked point of difference in the fact that the point of fullest cross-section in "Shamrock II." lies considerably farther forward than it does in "Columbia." Her bow is as much fuller as her run and quarters are finer than those of the American yacht; and the difference becomes accentuated as the yachts are heeled down in a breeze. Of neither model can it be said that, under all conditions of wind and sea and on all points of sailing, it is the better; for although the "Shamrock's" model should be easier to drive at high speed in a smooth sea, owing to the tendency to wave-making being less, the sharper sections of the "Columbia's" bow will give her an enormous advantage in a thrash to the windward mark in a strong breeze and against a short, steep sea. Under these conditions we expect to see "Shamrock" pounding heavily," as did "Vigilant" in the memorable windward and leeward race in 1893, while "Columbia" will take the seas with something of the ease which enabled "Valkyrie II." to reach the weather mark an easy victor over her bluff-bowed competitor. For sailing with sheets hard aboard there never was such a perfectly modeled and balanced boat among the 90-footers as "Columbia," and if the Cup is to remain another year with the New York Yacht Club it is upon this point of sailing that the victory will be won. In running and reaching there was but little to choose between "Columbia" and "Shamrock I.;" but "Shamrock II." has beaten the latter boat in a 13 to 17-knot breeze, under perfectly fair conditions, at the rate of 5 minutes in 15 miles of running, and 6 minutes in 10 miles on a broad reach. The result of the coming races will depend, as we have said, very largely upon conditions of wind and sea.

NEW YORK-BUFFALO ENDURANCE RACE.

A few months ago the Automobile Club of America announced that an endurance test between New York and Buffalo would be held in September. Owing to the various town and city ordinances, it was not possible to have a real long-distance race like the Paris-Berlin contest, but it was quite feasible to have a series of short runs in which the good points of the various machines could be brought out. A speed of 15 miles an hour was the highest which was permitted during the test. There were eighty-nine vehicles entered, and seventy-eight started at eight o'clock on the morning of September 9, from the Central Park plaza. The vehicles embraced almost every type of American machine. The arrangements were admirable and there was no confusion. The vehicles were started at intervals of thirty seconds, giving the spectators a chance to obtain a good view of the various carriages. There was an absence of the very high-power machines, such as the 40-horse power Winton racer and the racers of Albert Bostwick and W. K. Vanderbilt, Jr. The journey was made by way of Poughkeepsie, Rhinebeck, Hudson, Albany and then through Schenectady, Amsterdam, Fonda, Herkimer, Syracuse and Rochester. At Rochester, owing to the death of the President, the run was abandoned.

The first day's run included a hill-climbing contest up Nelson Hill, three miles north of Peekskill. It was very satisfactory, and fifty of the machines succeeded in climbing the hill. Not a single motor bicycle succeeded in reaching the top. The first half of the hill, which is nearly a mile long, has a sixteen per cent grade. The Grout Brothers' stanhope, a steam carriage, weighing 800 pounds, was the winner in the first class, as it climbed the hill in two minutes and forty-five seconds. Poughkeepsie was reached first by Mr. A. L. McMurtry, in a gasoline machine, arriving there at 3:30.

The next morning, September 10, sixty-eight machines started from Poughkeepsie. There were a number of minor accidents, but the system of checking was excellent. The men at one checking point got on to a train and moved to a distant station, while those that were behind them moved up one or two stations. Mr. David Wolfe Bishop's 30 horse power racer was the first to arrive at Albany, which city he reached at three o'clock. Mr. B. B. McGregor's 12 horse power gasoline car was next, and then followed Mr. Packard in a gasoline machine and Col. J. J. Astor in his new gasoline car. The distance was 75.4 miles and a stop was made at Hudson.

On September 11, sixty-six machines left Albany, and at the close of the control at Fonda only fifty-one had arrived. The first to reach Herkimer was D. W. Bishop in his French racer. He got in at 3:29, having made the 38 miles in two hours and fifteen minutes. The only woman to arrive within the time limit was Mrs. W. H. Browning, who accompanied her husband. The roads were very bad and the carriages and drivers were drenched with mud. One automobilist said he had ridden a thousand miles but never experienced worse conditions. After the run had started the first day, it was found that the "test run" had become a point-to-point race, the points being the noon and night "controls." This was not the case with all the competitors, but it was with the majority of them.

The start from Herkimer on September 12 was made at eight o'clock as usual, and Syracuse was reached at 2:34, D. W. Bishop coming in first, covered with mud and soaked to the skin with the heavy rain. The next arrivals were three steam carriages. Fifty-six of the carriages started from Herkimer, and the most of them had ropes tied around the driving wheels to prevent skidding. Quick traveling was impossible and the number of small accidents was considerable. The endurance test ended at Rochester, September 13, when the officers of the Club learned upon arrival of the precarious condition of President McKinley. Forty-one automobiles arrived at Rochester before the closing of the night control at half past ten o'clock and eight others came in during the morning, but they were not officially checked. The number of vehicles that made the start from Syracuse was fifty-one. The news of the President's death was received with great sorrow, and thirty of the chauffeurs decided to proceed to Buffalo at once, but the carriages were stripped of their numbers and there was no racing. The official figures show that of the sixty-seven automobiles that left Albany, fifty-one were in condition to start from Herkimer on the following day, while the same number began the trip from Syracuse to Rochester. The greatest loss was on the last day's run. The International Sweepstakes race of a hundred miles was also abandoned.

THE HEAVENS IN OCTOBER.

BY HENRY NORRIS RUSSELL, PH.D.

The season of eclipses has once more come round, though we in America will gain little by it. On the 27th instant occurs an eclipse of the moon, which, however, is only partial, as she passes so far north of the earth's shadow that less than a quarter of her disk is obscured. But as this happens at about 8 A. M., New York time, when the moon is overhead at Manila and consequently far beneath our horizon, we shall see nothing of it. The eclipse is visible generally throughout eastern Europe, Asia, and the western part of the Pacific Ocean.

Apart from this, the most interesting astronomical event of the month is the visibility of all the planets at once in the evening sky—that is, of all but Neptune, whose absence is small loss, since he can never be detected by the unaided eye. They are very far from being equally conspicuous, and their great diversity in brightness gives us occasion to explain just how such differences are expressed in astronomical language.

HOW STAR MAGNITUDE IS RATED.

We all know that the brightest stars are said to be of the first magnitude, and that those just visible to the naked eye are of the sixth, while the intermediate magnitudes express the gradations of brightness between these. But how is this system to be extended to the telescopic stars and to the brighter planets which much surpass the fixed stars?

It has been found, on measuring the brightness of the naked-eye stars, that, on the average, a star of any given magnitude gives about 2½ times as much light as one of the next lower magnitude. We can evidently extend this principle as far as we like, and so obtain a scale of magnitudes for the telescopic stars. If we make our scale such that a star of one magnitude is exactly 2½ times as bright as one of the next, we find that a first magnitude star would give 97.7 times as much light as one of the sixth magnitude. It is found more convenient to choose our scale so that any star is exactly 100 times as bright as one five magnitudes fainter. On this scale the ratio of the brightness of one magnitude to the next is 2.512. For practical purposes we may say that on this scale a star gives:

2½ times the light of one 1 magnitude fainter.
6¼ times the light of one 2 magnitudes fainter.
16 times the light of one 3 magnitudes fainter.
40 times the light of one 4 magnitudes fainter.
100 times the light of one 5 magnitudes fainter.
250 times the light of one 6 magnitudes fainter.

And so on.

The standard first magnitude is so chosen that the new system differs as little as possible from the old in the case of the stars visible to the naked eye.

As examples of stars which are of the first magnitude in this scale may be mentioned Aldebaran and Altair. The Pole star and the Pointers are nearly of the second magnitude. For an example of the third magnitude we may take Beta Cygni, which forms the foot of the "cross" of Cygnus.

The faintest stars visible to the naked eye are between the sixth and seventh magnitudes. A good field-glass will show stars between the eighth and ninth magnitudes. The most powerful telescopes yet constructed are just capable of showing stars of the seventeenth magnitude. Such a star gives but 1-25,000 of the light of the faintest stars visible to the unaided eye, and only 1-2,500,000 as much as Aldebaran.

The brightness of a star which gives more light than the standard star of one magnitude, but less than one of the next above, may evidently be expressed by a fractional magnitude. A difference of much less than a tenth of a magnitude, or about 10 per cent of actual brightness, is only perceptible by a trained eye.

But how shall we express the brightness of those bodies that are brighter than our standard first-magnitude stars? Capella, for instance, is about 2½ times as bright as Aldebaran. Referring to our table, we see that the difference in brightness is one magnitude. But the number expressing the magnitude of the brighter star must be smaller. Therefore we must say that Capella is of the magnitude 0. We may indeed have to go farther than this. Sirius is nine times as bright as Aldebaran. This amounts to 2.4 magnitudes. Hence we can only express the brightness of Sirius by saying that it is of magnitude —1.4, the negative sign expressing that it is much brighter than other stars.

This notation appears cumbersome at first sight, but a little practice shows it to be very convenient. An instance of this is afforded by its application to the planets.

Venus is at present of the —3½ magnitude; that is, she is 4½ magnitudes brighter than Aldebaran, and sends us some 70 times as much light. Jupiter's magnitude is about —2. He is consequently hardly twice as bright as Sirius, and about 16 times as bright as Aldebaran.

Mercury is of about the —0.5 magnitude, being intermediate between Sirius and Capella in brightness.

Saturn is a little above the first magnitude, say 0.8.

Mars is now so remote from us that his magnitude is 1.8, and he is but little brighter than the Pole star.

Finally, Uranus is of the sixth magnitude, and sends us only 1-100 the light of Aldebaran and but 1-7,000 that of Venus.

Neptune's magnitude is about 8.5, and consequently he cannot be seen without a strong field glass.

THE PRINCIPAL CONSTELLATIONS

visible at 9 o'clock in the evening in the middle of October are as follows: The Great Bear is on the northern horizon, below the pole. On the left of the pole is the Little Bear, surrounded by the coils of the Dragon. Cepheus is directly above the pole, with Cassiopeia on the right.

Hercules is low in the northwest, and above him is Lyra. Cygnus and Aquila are conspicuous in the Milky Way. A little south of the zenith is the great square of Pegasus. Aquarius is below, and beneath him the Southern Fish. Still lower, just on the southern horizon, are a few stars of the constellation of the Crane, which is well seen only in southern latitudes.

Capricornus is west of Aquarius, and Cetus occupies all the lower southeastern sky. Above him are the inconspicuous Pisces and the smaller, but more prominent, group of Aries.

Near the eastern horizon the Pleiades and Aldebaran show that Taurus has returned to our evening skies. From the northeast corner of the square of Pegasus runs a line of stars through Andromeda to Perseus, below which, in the same direction lies Auriga.

THE PLANETS.

Mercury is evening star in Virgo and Libra. His greatest elongation occurs on the 11th, when he is 25 degrees east of the sun. Being far south, he remains above the horizon only about three-quarters of an hour after sunset, and is consequently not easy to see. During the latter part of the month he is too near the sun to be seen.

Venus is evening star in Libra and Scorpio, and is conspicuous in the southwest after sunset. She sets a little after 7 P. M. On the morning of the 10th she is in conjunction with Mars, passing south of him, at a distance of less than a degree. She is also in conjunction with Uranus on the 25th, but this time she is nearly three times as far away.

Mars is evening star in Scorpio. He is faint and only visible in the twilight, and will be best seen when pointed out by Venus on the 10th.

Jupiter is evening star in Sagittarius, setting at about half-past 9 on the 15th. He is moving eastward, and rapidly overtaking Saturn, their apparent distance being only half as great at the month's end as at its beginning.

Those who have small telescopes can see an unusual sight on the evening of the 15th, when only the fourth satellite will be visible, since the first is behind Jupiter, the second in front of him, and the third hidden in his shadow. This phenomenon is repeated on the 22d, but the planet will then be so near setting that it cannot be observed in this part of the country.

Saturn is also in Sagittarius, and sets a few minutes later than Jupiter. He is in quadrature with the sun on the 3d, and comes to the meridian at 6 P. M.

Uranus is evening star in Scorpio, setting at about 8 P. M. in the middle of the month, and is so far involved in the twilight that he can be seen with difficulty, if at all.

Neptune is in Gemini, rising about 9 P. M. on the 15th.

THE MOON.

Last quarter occurs on the afternoon of the 4th, new moon on the morning of the 12th, first quarter near noon on the 20th, and full moon during the eclipse on the 27th. The moon is most remote on the 14th, and nearest on the 27th. She passes Neptune on the night of the 3d, Mercury on the afternoon of the 14th, Mars on the evening of the 15th, Venus on the following morning, Uranus on the night of the 16th, Jupiter on that of the 18th, Saturn on the morning of the 19th, and Neptune again on that of the 31st.

Oyster Bay, N. Y., September 17, 1901.

THE M. SANTOS-DUMONT BALLOON No. 6 FAILS.

M. Santos-Dumont, the plucky young Brazilian aeronaut, has again come to grief with his new balloon, which is the sixth he has constructed. After the accidents of July 13, August 8 and September 6, it might be supposed that he would have quit his experiments for the season, but as the atmospheric conditions for which he had patiently waited were nearly perfect on Thursday, September 19, he decided to make the ascent. He passed the night at the balloon house, to take advantage of the early morning hours. He started from the Parc d'Aerostation at twenty minutes past eight o'clock in the morning, and crossed the Seine without any difficulty, and maneuvered successfully for an hour over the Longchamps racecourse. His success was so great that he decided to spend the whole day in experiments, but his motor began working badly, and while turning around the balloon was driven against some high trees and torn, allowing the gas to escape. The frame was broken as soon as it touched the ground, and M. Santos-Dumont walked cheerfully out of the ruins and shook hands with his friends. He was much vexed at the loss of his new balloon, which he had constructed with so much care. The accident to the machine was so serious that it will take several weeks to repair it, but notwithstanding this fact, he is going to resume his experiments as soon as the Santos-Dumont No. 6 can be repaired. If the weather conditions are favorable, he will make other ascents in October and November, and it is possible that he may take the entire apparatus to the South, where the atmospheric conditions are better.

SCIENCE NOTES.

Works of art in Rome are not particularly well guarded. The Church of Santa Sabina, on the Aventine, recently lost a picture by Sassoferrato, called "The Madonna of the Rosary." The monks found a light in the chapel which contained the picture, and on investigation found no trace of the painting except the frame and a piece of candle.

M. O. Leighton, Health Inspector of Montclair, N. J., declares that he has found bacteria to be quite abundant in clay that has been used and reused for modeling in schools. An attempt to sterilize the clay showed that the only efficient way of accomplishing this was by the use of superheated steam under a pressure of 15 to 20 pounds for 45 minutes. The species of bacteria identified were those which occur in pus formations. Sterile clay was then inoculated with the bacilli of typhoid, diphtheria and tuberculosis. A study of the clay showed the typhoid germ to be alive after 32 days and the diphtheria and tubercle to be still alive in 18 days.—The Druggists' Circular.

It is well known that wasps do much injury to fruit, and complaints have been numerous this season from many quarters in this country; but it appears that the possible injury to fruit by bees has been the subject of an exhaustive investigation by the California experiment stations. The conclusions arrived at are that although the mouth parts of bees are so constructed that they might be used for both eating and injuring fruit, all the evidence obtainable points to the fact that it is very seldom that any injury is done. In this country the bee has rarely been accused of doing any injury to fruit, but in the fruit-growing districts premiums are offered for the destruction of wasps' nests.

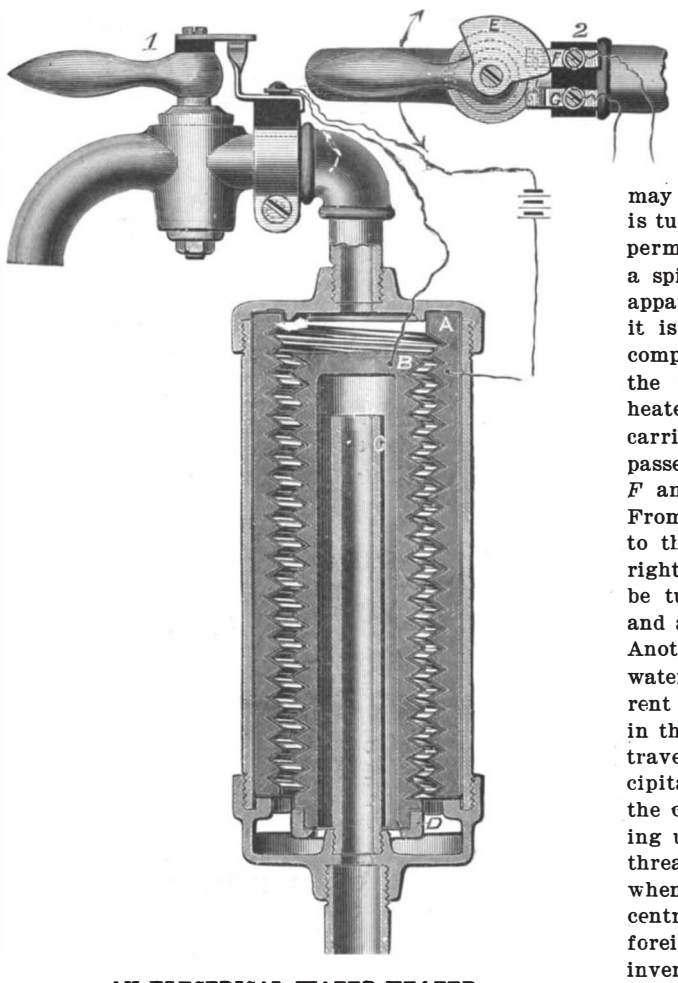
Experiments have been made at Havana to test whether yellow fever is carried by mosquitoes. Out of eight persons bitten by infected insects three have died, three have the fever and will possibly recover, one is not affected, while as regards the remaining case it is too early to make a diagnosis. The physicians are shocked at the result of the experiments. It was supposed that direct infection from mosquitoes caused only a mild form of the disease, and was a safe means of making the subject immune. It is now definitely known that a man bitten by an infected mosquito after being inoculated with the serum introduced by Dr. Caldas, a Brazilian expert, has developed a genuine case of fever.

R. T. Hewlett has made some experiments on the thermal death point of the tubercle bacillus (Trans. of the Aberdeen Congress, 1900, Roy. Inst. of Pub. Health). His conclusions are that: 1. As regards a non-virulent laboratory culture, a temperature of 60 deg. C. acting for ten minutes is sufficient to destroy the vitality of the bacilli. 2. A temperature of 65 deg. C. acting for fifteen minutes destroyed the infective properties of tubercular sputum in five out of six instances. 3. Tuberculous milk heated to 60 deg. C. for thirty minutes lost its infective power. 4. Tuberculous milk heated to 68 deg. to 65 deg. C. for twenty minutes in the Allenbury's pasteurizer lost its infective power. 5. In all probability pasteurization in which the milk is retained at a temperature above 65 deg. C. for not less than twenty minutes is efficient, especially if no film is formed.

The following information relative to the discovery of petroleum in New Brunswick was transmitted by Commercial Agent Beutelspacher, of Moncton, under date of August 15, 1901: "For some years past different parties have been prospecting for petroleum in this province. Very little success attended their efforts, however, until the present year, when a company operating at Memramcook, about 14 miles distant from Moncton, struck a well which it is thought will yield in paying quantities. It is producing from eight to ten barrels of oil per day. There is also a good flow of gas. The 0.860 specific gravity oil has been subjected to fractional distillation, according to the Engler method, and was found to yield a very high percentage of good burning oil. The company has placed three more boring rigs in the field, and is extending its operations rapidly."

AN ELECTRICAL WATER-HEATER.

There are many occasions when the instantaneous heating of water is rendered necessary. It may be desirable to let the fire which heats the water in the boiler go out, as in summer or at night, and in many places electricity can be obtained where running water does not permit of a hot water system. The



AN ELECTRICAL WATER-HEATER.

device shown in our engraving obviates these difficulties wherever a current of electricity can be obtained.

The top of the device consists of a spigot, the manipulation of the handle of which in one direction sends a current of electricity through the heater so that hot water may be obtained, while by turning the handle in the opposite direction it will result in cold water issuing from the spigot. A core is secured to the supply pipe, which, of course, permits of a water pressure being maintained in the pipe at all times. The water passes up the pipe, *C*, through the surrounding channel and out through the ring-shaped orifice, *D*. The water then passes up the zigzag passages and out through the spigot. The core, *B*, is preferably made of carbon pressed into shape, this inner core and its inclosing cylinder forming electrodes of an electric current. The periphery of the core, *B*, is provided with spiral grooves in the shape of screw threads.

The faces of the threads are covered by some suitable fabric which is pressed into shape when the core is being formed. The wire or cord is wound around in the bottom of the grooves to hold the cloth or fabric in its desired position. The object of incasing the carbon core or electrode with cloth or fabric is to prevent the disintegrated carbon passing out through the spigot with the running water, in addition to which the presence of the fabric enables the core to be molded much easier and it will hold its shape better than where the sharp corners of the green carbon are exposed. Surrounding this core is a cylinder which is threaded into the base casting, and whose top is closed by a cap. This cylinder carries the encircling electrode, *A*, which is insulated from its support, as is also the core, *B*. The electrode is formed with spiral grooves in its inner face, corresponding with the thread of the core, so that the water must necessarily follow the zigzag path. The inner face of the electrode is covered with fabric for the same reasons as have already been given. The core terminates short of the cap-piece, forming a chamber in the upper part of the heater from which leads the discharge pipe, which in turn runs to the spigot, which may be of the usual style, or may be constructed so that when the operating handle is turned in either direction the spigot will be open to permit the passage of the water. With the aid of such a spigot it is possible to run cold water through the apparatus when it is turned in one direction, and when it is turned in the opposite direction the circuit is completed and the electrodes are energized so that the water passing through the apparatus will be heated before it issues from the spigot. The handle carries a contact making and breaking plate, *E*, which passes over the face of the two terminal contact points, *F* and *G*, which are secured to an insulation block. From these terminals wires lead to the core and to the electrode. When the handle is turned to the right the water will not be heated, but if the handle be turned to the left the circuit will be completed, and all the water which passes through will be warm. Another interesting feature is the fact that the hot water, at least, will be sterilized, for a 110-volt current will destroy all the animal and vegetable matter in the water, the zigzag path which it is compelled to travel being advantageous; and it also tends to precipitate any foreign matter in the grooves without the core or the encircling electrode. The water passing upwardly through the zigzag path formed by the threads will also be given a whirling motion, so that when it reaches the chamber in the top of the heater centrifugal action will assist in ridding the water of foreign particles. This very interesting and useful invention was recently patented by H. M. Hill.

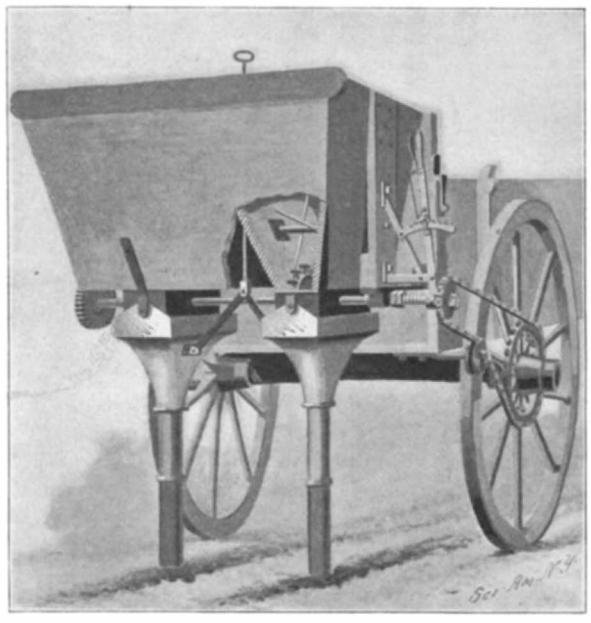
AN IMPROVED FERTILIZER-DISTRIBUTER.

A fertilizer-distributer which can be fitted to an ordinary wagon, and which is of such construction that it can deliver material within a wide range, is the subject of an invention patented by Harris McVea, of Vanceville, La.

The frame of the distributer consists of a backboard and a downwardly and inwardly inclined front section. When the device is to be used, the tail-board of the wagon is taken out and the backboard of the distributer substituted.

Within the frame two hoppers are located, through both of which an agitator-shaft passes, serving to break up the lumps in the material. Beneath the agitator-shaft a feed-wheel shaft is mounted, the feed-wheels being arranged so that they turn in the discharge openings of the hoppers. This feed-wheel shaft is driven from one of the rear supporting-wheels of the wagon by a sprocket-and-chain gear, a lever-operated clutch mechanism being provided to throw the feed-wheel shaft into and out of gear with the supporting-wheel of the wagon. Slides are provided for closing the discharge-openings of the hoppers.

The fertilizer, fed by the wheels, passes through two spouts to the ground, which spouts are pivotally mounted and are swung to or from the ground by means of two links pivoted to the spouts and operated by a vertical handle-bar provided with means whereby it can be held in any adjusted position. By thus pivotally mounting the spouts and adjusting them for any width between rows, the fertilizer can be delivered within a wide range. The fertilizer is to be carried in the wagon and supplied to the hoppers in any desired manner.



AN IMPROVED FERTILIZER DISTRIBUTER.

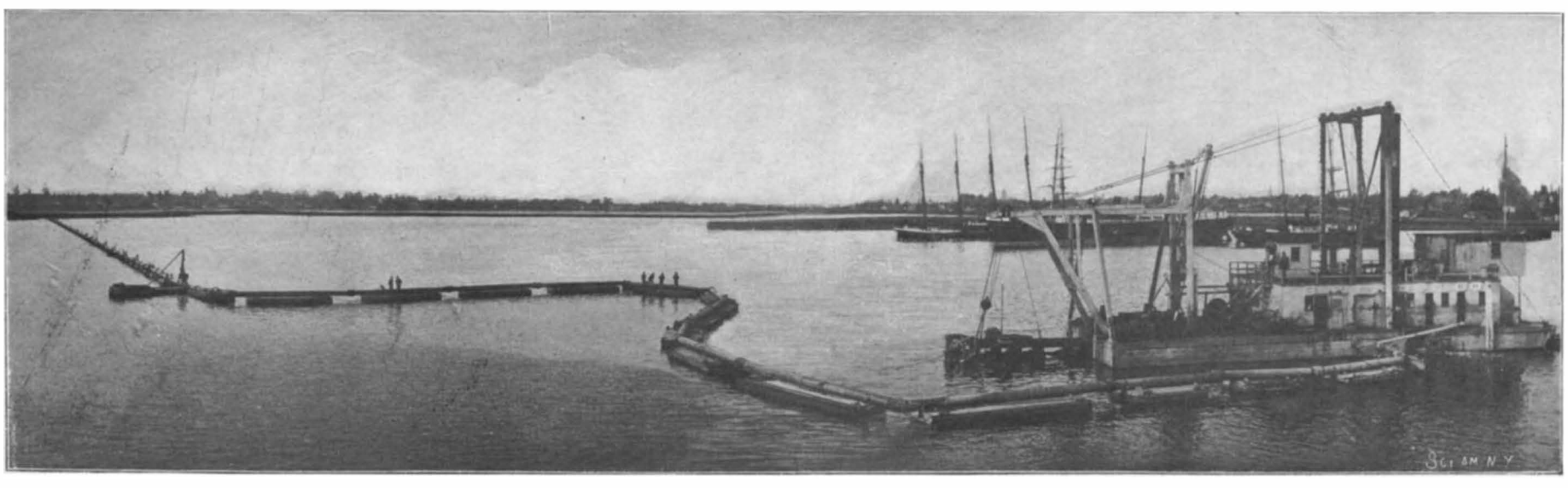
HARBOR IMPROVEMENT, OAKLAND, CAL.

The improvement of Oakland Cal., Harbor is one of the greatest undertakings of the general government on the Pacific Coast. In 1874 a shallow estuary flowed through a vast extent of marsh land, mostly covered at high water. A recent report of the commerce of the estuary, after the 20-foot channel had been dredged, indicated that freight to the amount of 3,254,215 tons and passengers to the number of 186,360 had been transported in 1899.

The purpose of the improvement is to extend deep water navigation to the two prosperous cities, Oakland and Alameda, which have a joint population of 100,000. The new harbor lies between these communities, both of which have extensive manufactories, which find splendid sites on land which has been raised above tide by material dredged from the channel. There are also admirable facilities for the economical shipment of freight. Shipbuilding, lumber yards, iron works, the handling of coal and other heavy products, are concentrated on the banks of the new channel. The added value of the reclaimed ground amounts to many times the cost of the improvement, which up to date is $2,450,000. The first appropriation for the improvement was made in 1874, and amounted to $20,000. The scheme is now but partially complete. Two stone jetties start from the deep waters of San Francisco Bay and extend, the north one 13,000 feet, and the south jetty 10,000 feet, in parallel lines, 800 feet apart. The jetties, or training walls, are composed of stone, and between these walls a channel 20 feet in depth and 300 feet in width, has been dredged. The total length of the harbor is 19,000 feet, and at the easterly terminus a tidal basin 300 acres in extent has been deepened, so as to afford a safe harbor for accommodation of ships out of commission or laid up for the winter.

From the channel alone 647,715 cubic yards were raised by dredging, and deposited on the shores. Several thousand acres have been thus reclaimed. The first scope of the Oakland Harbor improvement was greatly below present realizations. The jetties have been raised several feet, and a strong movement has been inaugurated to increase the channel to a width of 500 feet at the present depth and to extend its length to double its present dimensions.

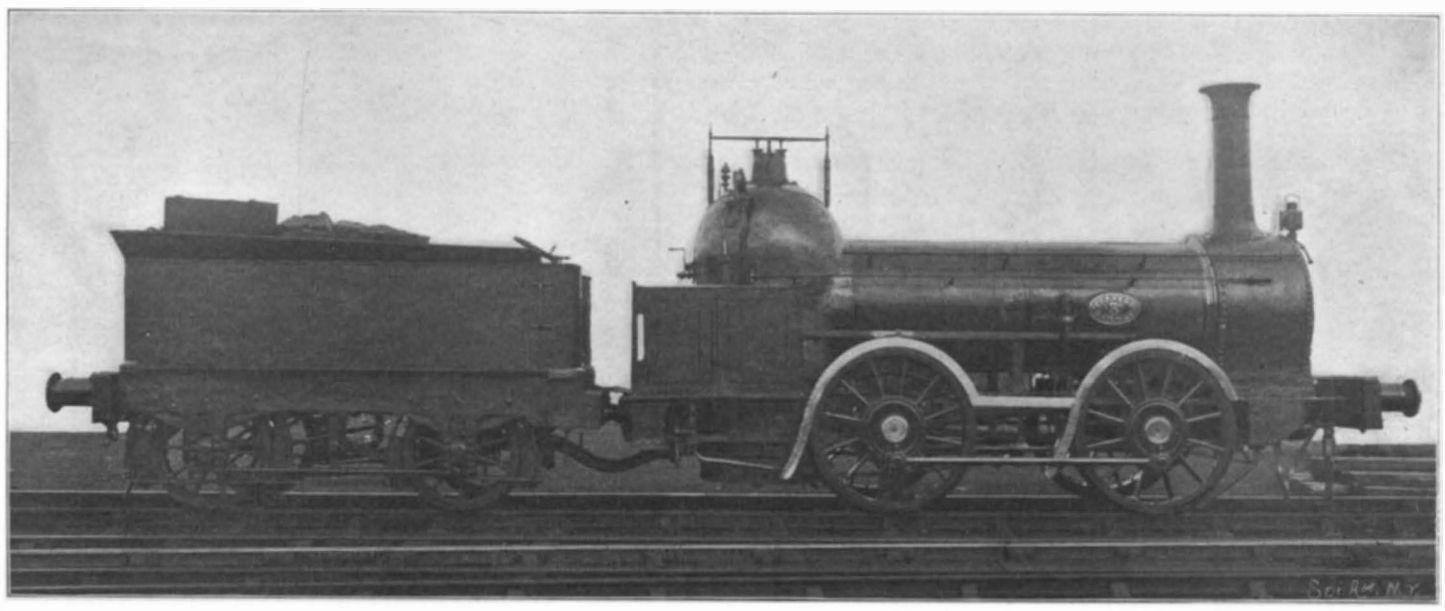
The material through which the channel was dredged consists of mud, sand, and a hardpan. Be-



HARBOR IMPROVEMENT, OAKLAND, CAL.

tween the jetties deposits of hardpan were met with; but the rotary cutter of the hydraulic dredger found no particular difficulty in breaking into this material. The hydraulic dredger used in late years measures 120 by 40 feet, with engines of 400 horse power and with a suction and discharge pipe 20 inches in diameter. Depending upon the character of material, its capacity ranges from 1,000 to 5,000 cubic yards per day.

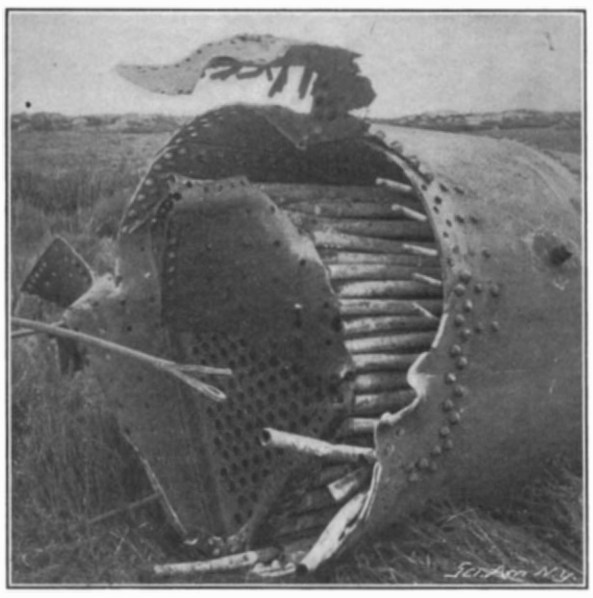
On the east side of San Francisco Bay the shallows extend from the shore line fully two miles. Upon this flat the currents from the rivers discharging into the bay are driven by prevailing westerly winds. In time of flood, these river waters are full of sediment, which is deposited when the comparatively calm areas of the lower bay are reached. The ferry landings on the east shore are of great length. The Oakland pier is fully two miles in length, and the one at Alameda nearly twice as long. Both are of pile work, which suffers terribly from the destructive ravages of the teredo. Gradual progress has been made in filling in the trestles, especially on the Alameda pier, which runs directly on one side of the new channel. The material for filling is obtained by dredging from the estuary and utilized for making a solid roadbed for the railroad tracks. A space 9,000 feet long and 150 wide to a depth of 10 feet was recently filled in this way. A bulkhead was built on each side of the track, and into this space a pipe 20 inches in diameter, extending from the dredger, 5,700 feet distant, and supported by pontoons and piles, discharged a continuous stream of gravel and water, until the present solid roadbed of solid material was formed. The Oakland Harbor improvement has proved of even greater value than anticipated. The works are in charge of Col. H. E. Heuer, of the U. S. Corps of Engineers.



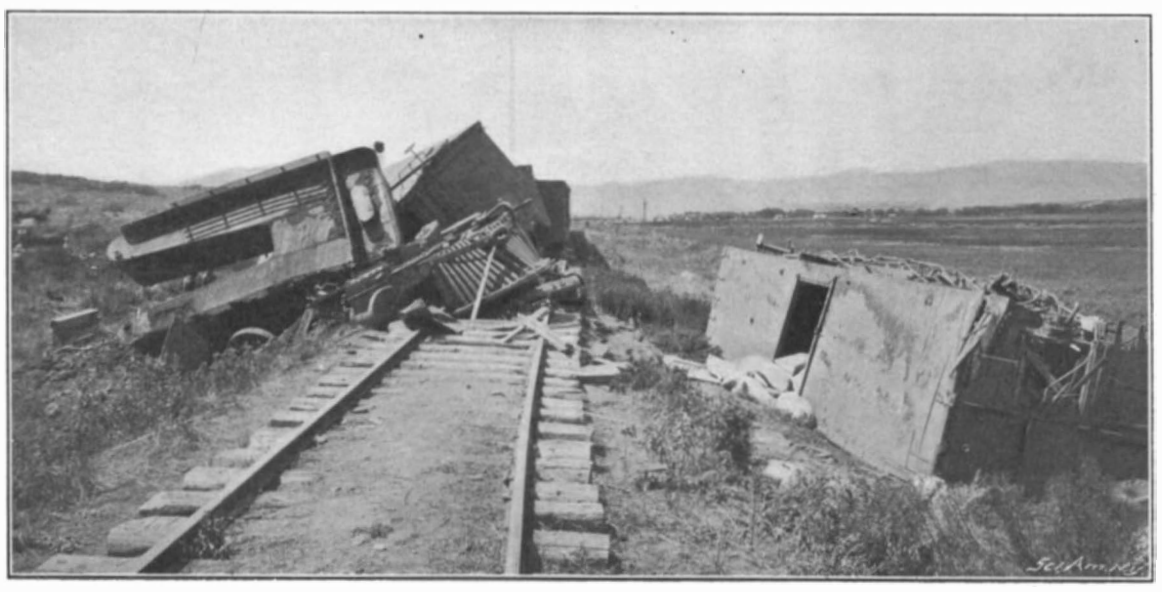
EARLY ENGLISH LOCOMOTIVE; IN SERVICE 1846 TO 1901.

CURIOUS LOCOMOTIVE EXPLOSION.

The accompanying illustrations are reproduced from photographs of an unusual railroad wreck which occurred to a local passenger train on the Denver & Rio Grande Railway, between La Veta and Cuchara, Colo. The disaster was due to the rupture of the boiler at the junction of the barrel and the firebox. The train consisted of a locomotive, ten freight cars, and a passenger coach at the rear, in which were some twenty-five passengers. The explosion occurred when the train was about one mile distant from La Veta station. The engineer and the fireman were instantly killed, and the concussion was so violent that buildings a mile distant from the track were severely shaken, and the noise of the explosion was heard at points twenty miles away, where it was supposed that an exceptionally heavy mining blast had been set off. The body of the engineer was found between 500 and 600 feet distant from the track and mutilated beyond recognition. The engine, as will be seen from the illustration, was completely wrecked. The upper sheet of the firebox was torn entirely loose from the boiler, and thrown a distance of over 600 feet to the right, landing on ground which was about 50 feet above the level of the track. The force of the explosion was sufficient to strip the boiler entirely from its seating, and the barrel was driven forward with a rocket-like action along the ground, plowing a deep furrow at the left of the track for a distance of 125 feet. The blast was also sufficient to tear the body of the tender loose from its frame and throw it around at right angles to the track, as shown in the accompanying illustration. The first car behind the tender was overturned and landed bottom up, to the left of the track, while the second and third cars were thrown over to the right. One of our illustrations shows the point at which rupture took place in the boiler. It will be seen that the firebox is entirely gone and the tube-sheet and tubes are exposed, showing the staybolts either ruptured or pulled out. Several staybolts, we are informed by our correspondent, were found to be eaten through and others almost through by the action of the alkali in the water.



The Wrecked Boiler.



View from Front of Train.

LOCOMOTIVE EXPLOSION AT LA VETA, COLORADO.

A LOCOMOTIVE CURIOSITY.

There has just been withdrawn from service in England one of the oldest locomotives in existence. Up to a few weeks ago this engine, which was constructed in 1846, was regularly employed for hauling mineral traffic upon the Barrow-in-Furness Railroad, which was one of the first railroads in England, having been opened for traffic for considerably more than half a century. The total length of this railroad is only 170½ miles, yet it is one of the most profitable lines in the United Kingdom, a fact due to a large extent to the heavy mineral traffic that it carries.

This engine, officially known as "Number 3," but familiarly styled "Old Coppernob," from its curious firebox, which is built of copper and is dome-shaped, is the survivor of three similar engines that were built in the early '40's for this railroad, though the two previous engines were somewhat smaller. The cylinders are 14 inches in diameter, with a 24-inch stroke. The steam pressure was 120 pounds per square inch. The heating surface of the tubes is 805 square feet, and of the firebox 49 square feet. The total weight of the engine and tender in working order was 32 tons 8 hundredweight. The wheels are four coupled, 4 feet 9 inches in diameter on the tread, and the engine frames are of the frame type with upper and lower members. The axle boxes are made of gun-metal and the motion is of the curved link type. The boiler is 11 feet 2 inches long and 3 feet 6 inches in diameter. The boiler plates are made of Low Moor iron throughout with the exception of the firebox, the barrel being made up of three rings.

A curious feature of the tender of the engine is that the under frame is constructed entirely of oak. The tender has a water capacity of 1,000 gallons. Although this old locomotive has been regularly running for over 53 years, when withdrawn from service it was found to be thoroughly strong and perfect in every respect. The working parts were in first-class condition. Although old-fashioned in design and pattern, it was a very serviceable engine, and an idea of the serviceableness of this type of locomotive may be gathered from the fact that the same company has several other similar "copper-nobs," though of a more recent date, still running upon its system.

Now that it has been withdrawn from active service the locomotive is to be placed in a well-merited place of honor. The railroad company are having a special glass-covered case erected in a prominent position at their Barrow terminus to accommodate the relic, and it will constitute an interesting memento of the early days of the railway era and also form a striking contrast with the fleeter and more powerful locomotives of to-day.

Use of Old Wooden Paving Blocks.

An ingenious use has been found for the discarded wood blocks with which the London streets are paved. The woods employed for this purpose are the karri and jarrah woods of Australia, which, owing to their density of grain and extreme hardness, are peculiarly adapted for paving purposes. This wood, owing to these characteristics, is familiarly styled "ironbark." Hitherto when a street was renewed the old wood blocks were sold at a low figure to the poorer classes, and in some instances were given away to those who cared to carry them away. They are, however, now being put to a new use. The wood blocks are in reality only surface damaged. The inside is as hard and as durable as it was when first laid down. Realizing this feature, several toy manufacturers throughout the country approached the authorities, and now purchase all those blocks which are not damaged in the process of being torn up, for the purpose of making the cheap toys out of them. The wood is bought at a low figure, and by means of special machinery that has been laid down the outside is trimmed off and the remaining portion converted into small toys. The wood, owing to its strong nature, is excellently suited for this purpose; and owing to the fact that the raw material is purchased so cheaply the home manufacturers are in a position to undersell consider-

ably the foreign competitors. Hitherto Germany has enjoyed a monopoly in the English toy market. Even cheap labor cannot place the toys upon the market at the same price at which the English manufacturer is selling his products, and at a highly satisfactory profit to himself.

ROLLING LIFT BRIDGES.

BY WALDON FAWCETT.

The rolling lift bridges which have been constructed during the past few years in Chicago and at other points in the United States constitute so distinct an advance over the types of movable structures heretofore utilized in spanning navigable waterways as to have aroused deep interest abroad; and the favorable verdict upon their claims for superiority indicated by the arrangements for the installation of similar bridges abroad is particularly significant in view of the fact that the most distinguished European engineers have for more than half a century wrestled with the problem of accommodating the highway traffic over congested waterways such as the Thames River.

The essential requirements of a movable bridge are many in number; a fact which, of course, lends interest to the solution of the engineering problems involved. In the first place, the bridge must be absolutely safe for all traffic crossing it and for traffic using the navigable gateway, and its mode of operation must be such as to cause the least possible delay both to the traffic crossing it and that using the waterway. Then there are other considerations, such as the desirability of providing the widest possible navigable channel, the non-encroachment on the dock space adjacent to the bridge, and, finally, the matter of economy of operation.

The original movable bridges which are of any interest from an engineering standpoint are what are known as the mediæval pivot or trunnion bascule bridges, which were used to span the moats surrounding fortresses or castles and which, when closed effectually, shut off communication. These bridges either revolved upon hinge pivots or trunnions in a vertical direction or were counterbalanced on the principle of the seesaw. During the first half of the century which has just closed a number of pivot bascule bridges were built, the spans ranging from 20 to 50 feet. The year 1869 saw the completion at Copenhagen, Denmark, of the largest bascule bridge which had, up to that time, been constructed. The bridge, which had a total width of 31 feet, consisted of two movable leaves operated by hydraulic power and gave a clear channel of nearly 57 feet. Some nine years later the honor of ranking as the largest bridge of this type passed to a structure erected at Rotterdam, Holland, which had a total width of 34 feet and gave a clear channel of over 75 feet. This continued to be the largest pivot bascule bridge until the erection of the Tower Bridge at London.

The development of the pivot bascule bridge led directly up to the invention of the rolling lift bridge, the latter type having been devised just as the Tower Bridge at London was nearly completion. The famous London structure was commenced in 1885 and completed in 1894. It provides a waterway 200 feet in width, and cost, all told, more than $4,000,000. The advance which has been made in movable bridges of late years could not, perhaps, be better illustrated than by comparing the Tower structure with a rolling lift bridge of even greater span at the entrance to the Grand Central Station at Chicago. The weight of the iron and steel in the London bridge is 14,000 tons, while that in the Chicago bridge is but 2,250 tons, and the entire cost of the latter was $126,000, less than the cost of the operating machinery alone of the Tower Bridge.

Only three types of movable bridges have been extensively used: First, the hinged, pivot or trunnion bascule bridge; second, the rolling lift or bascule bridge, the newest type; and, third, the swing bridge, commonly denominated "drawbridge," which has been in general use for years past by railroads all over the country. The invention of the rolling lift bridge grew out of the requirements of the Metropolitan West Side Elevated Railroad, which sought a way to carry the traffic of their four tracks across the Chicago River so as to enter the business center of Chicago. Various obstacles prevented the erection of a swing bridge and objections equally insurmountable precluded the possibility of operating satisfactorily a pivot bascule bridge patterned after the Tower structure in London. When it became apparent that the problem was to prove a grave one, William Scherzer set to work upon it and ultimately evolved the idea of the present rolling lift bridge.

The mode of operation of the rolling lift bridges is, as will be seen from the accompanying illustrations, extremely simple. Upon the approach of a boat the bridge seemingly splits across the middle and each half rears itself upright on the bank on which its shore end is resting. The two great advantages claimed for the rolling bridges, aside from economic considerations, are found in the fact that since no center pier is necessary for the support of the structure the entire navigable channel is available and is unobstructed for the passage of vessels, and in the form of construction which enables the rolling lift bridge to act as a barrier when opened for the passage of vessels, thus closing the roadway and preventing the accidents which have been caused in years past by trains running into open "draws."

One of the most recent demonstrations of the utility of the rolling lift type of bridge is found in the evidence that a number of contiguous railroad tracks may be carried across a waterway by the construction of single or double track bridges placed side by side. These bridges may be coupled together when it is desired to operate them as one bridge, or each bridge may be equipped so as to be operated separately. The first six-track movable bridge ever constructed was completed in 1899 at the South Terminal Station in Boston, the largest terminal station in the world. The Boston bridge consists of three double-track spans, which may be operated jointly or as one span. Still more remarkable is the eight-track bridge which has been but lately completed to form a crossing at Campbell Avenue, in Chicago, over the Chicago Drainage and Ship Canal, which is to form a connecting link in a navigable waterway between the Great Lakes and the Gulf of Mexico.

Electric power is used in the operation of rolling lift bridges, but the force required is surprisingly light in view of the fact that the movable spans are perfectly counterbalanced and roll or rock with a minimum amount of friction. Trials have proved that less than twenty seconds is required for the complete operation of opening and closing the spans of one of the largest bridges. In the case of the large bridge at Boston, previously mentioned, each double-track span is operated by means of a 50 horse power electric motor, and the bridge is usually opened or closed in less than 30 seconds, including the time required for locking or unlocking. Moreover, the entire bridge is operated by one man.

A most interesting record is that of the Rush Street Bridge, at Chicago, said to be the most active movable bridge in the world. During an average season of lake navigation comprising a little over eight months this bridge is opened between 10,000 and 11,000 times, or fully forty times every twenty-four hours. Yet the power expense for the operation of this bridge by electricity does not exceed 67 cents a day. Over another rolling lift bridge in Chicago the passage of trains aggregates 1,200 daily.

A novel plan has been followed in order to make the rolling lift bridges more rapid in movement and to insure absolute safety of the working parts, even in the event of an accident to the operating machinery. The movable leaves comprising a bridge are so counterweighted that they are at rest when opened at an inclination of about 40 degrees instead of in the horizontal position which they occupy when closed. Thus, as soon as the locks are withdrawn the leaves will, without the application of any power whatever, roll back and upward and open a channel of sufficient width for the passage of vessels.

The rolling lift bridge moves by means of a large circular wheel rocking upon a perfectly smooth and level track, and, in localities where the waterway to be crossed is comparatively narrow, bridges have been constructed with but a single leaf or span. It is claimed that one of these rolling lift bridges when open is more stable against wind pressure than the Eiffel Tower or the Park Row building in New York city. The engineers admit that larger stresses are safely carried by the substructures of the Forth Bridge and the Brooklyn Bridge than will ever in all probability have to be carried by the substructure of the longest span rolling lift bridge which is likely to be constructed, but they contend that were a span longer than either of the above required, sufficient substructure, counterweight and machinery could be provided to open or close the span. With a view to developing the artistic and monumental possibilities of rolling lift bridges some very handsome designs have lately been prepared. In such structures the counterweight and operating machinery will be inclosed and protected by monumental masonry.

The first International Congress of Petroleum was held in Paris in 1900, and the second has been fixed for 1902, at Bucharest. The permanent commission which was formed at the Congress of 1900 has its seat at Paris, and is constituted as follows: President, M. Ed. Lippmann, former president of the Société des Ingénieurs Civils of France; vice-president, M. Van Zuylen; general secretary, M. P. Dvorkowitz; assistant secretary, M. Neuburger, 37 rue Scheffer, Paris, to whom communications may be addressed. M. Dvorkowitz has lately founded at London a petroleum institute. This new establishment is designed for the uniting and studying of all matters relating to the geology, extraction, chemistry and manipulation of petroleum and its derivatives.

Correspondence.

The Design of Propellers.

To the Editor of the Scientific American:

Your comments on the design of propellers in issue of September 7 correctly sums up the present situation of the subject.

Years ago, when Rankine enunciated the theory of propulsion that a vessel was made to move forward by the propeller moving a mass of water in the opposite direction, and the larger this mass and the slower its velocity, the more economical would be the performance of the propeller, it became the custom to use propellers of large diameter and small pitch ratios. But experience taught that for a given case it was just as easy to have a propeller too large as too small in diameter, and that very small pitch ratios were extravagant in the use of power. When this fact was becoming recognized the writer pointed out that there was another factor which entered largely into the matter of propulsion, and which made the subject even more complicated and difficult to comprehend—it is that of the inertia of the water acted upon, or its resistance to being put in motion by the propeller.

The notion of a propeller churning the water, when revolving at a high speed, when properly designed and applied, should be exploded by this time, because it will not do so even when the vessel is made fast; but in this latter case it will simply act as a pump receiving the supply water at its forward end and discharging at the opposite. The only time when there is any likelihood of churning is when it is so situated that it cannot receive an adequate supply of water at its forward end.

Experience with propellers taught contrary to general belief at one time that very long screws were not efficient. In the case of propeller. pumps it was found that by dividing a long screw into several shorter ones and situating them some little distance apart on the shaft that a better performance was secured. Here, then, we have some explanation of the good performance of the propellers of turbine vessels. They are favorably situated to receive their supply water and each separate propeller on the shaft acts as an independent one.

The field for improvement in screw propellers by any change in their configuration is extremely limited. But there is one direction in which a promising opportunity is presented for improvement in propulsion, and it is somewhat surprising that it has not received more attention than it has.

It is to utilize the energy in the water discharged by the propeller which is now allowed to go to waste.

A great many persons, even some fairly informed in marine engineering, cannot comprehend how any considerable loss takes place in this particular.

Let it be understood that the action of a screw propeller in driving a vessel is the reverse of a turbine wheel in driving a mill. In the case of the latter the object to be accomplished is to transmit through the shaft the power contained in the water flowing to the wheel and to have it absorbed in moving the machinery of the mill. In doing this a mass of water flows to the wheel with a velocity according to its gravitation and is discharged with a much less velocity. The energy due to this difference is that available for the work of the mill.

In the case of a propeller driving a ship, eliminating the factor of inertia before referred to, the water which it acts upon is at rest and it is necessary to give the water motion in order that the reactionary effect may furnish the thrust to move the vessel. To accomplish this the power developed by the engines is transmitted through the shaft to the screw which operates on the water, then discharges it with an accelerated velocity, action and reaction being equal; it is the reaction of this discharged water that furnishes the thrust to drive the ship. Now it is evident that energy is absorbed in moving the vessel and there must of necessity be energy in the water discharged by the propeller.

Hence the power of the engines is divided between moving the vessel in one direction and a mass of water in the opposite direction.

I. McKim Chase.

Washington, D. C., September 16, 1901.

Work on the by-product coke ovens at the Maryland Steel Company's Sparrow Point plant has begun. They are of a new type, and cause a saving of the tar, ammonia, and gas which is thrown off during the process of roasting the coal from which the coke is made. Coke for use in the furnaces of the company will be furnished by the ovens and will probably also supply coal gas for the use of the city of Baltimore. Illuminating gas from by-product coke ovens has been used at Everett, Mass., where a large coke plant has been in operation for some time. It is necessary to treat the gas after it comes from the coke. Cheaper grades of coal can be used in these new ovens.

Automobile News.

Among the recent Alpine trips in automobiles may be mentioned that of M. Anchorena, who made the ascent of the St. Bernard. The following is an extract from his journal: "Leaving Martigny on the 8th of August at 4 o'clock, we arrived at the hospice of St. Bernard at 9:45 in the evening. The slope, which is very steep after Bourg-Saint-Pierre, is even more accentuated at the Cantine de Proz. This point is at 5,550 feet altitude, and the hospice is at 7,600 feet, making in round numbers a difference of 2,050 feet. As the distance is 4.2 miles, this makes an average grade of 10 per cent, but in reality the grade reaches as high as 15.5 per cent at some points. We made the descent the following day at 2:30. The rear brake took fire from the friction caused by this rapid descent, and we were obliged to make the remainder with the aid of the reversing gear, putting the motor in movement. The whole distance of the climb (measured by the difference of altitude) is 6,170 feet; Martigny is at 1,480 feet altitude and the hospice at 7,600 feet as stated above. The motor worked admirably, and we were able to make a part of the ascent with the second speed. One detail should be noted; the mountain routes in Switzerland are forbidden to automobiles, and I was obliged on this account to pay a fine of $20. This prohibition results from the danger which the encounter of the machines presents to the mules, as they become frightened and risk falling over the precipices. The ordinary vehicles take 10 or 12 hours to make the ascent and 6 hours for the descent. The route is in good order, except near the summit, where there are quantities of loose stone."

Military automobiles of different types are now being constructed in all the leading countries of Europe. Several machines of new designs have lately been ordered by the German army. Among these is a light six-place vehicle, which has two seats in front and the other four disposed on each side of a small drawing table, on which maps, etc., can be spread out. A second machine is for the use of the artillery schools, to ascertain quickly the results of the target-ring. A third type resembles the English machine of the Simms pattern; it is an armored automobile of one place only, protected by heavy steel plates and carrying two Maxim guns. According to a circular recently issued by the Etat Major, the subject of military automobilism is to be of the first importance. At present the automobile is to be used by the artillery schools and for the fortified places and depots. As to the other types, their value will be best determined after the next grand maneuvers. This will no doubt be an important test of the military machines, as it will be remembered that the Reichstag has voted the sum of $35,000 for the purpose. The Russian government is now taking an active interest in the subject. It is said that a number of factories are to be erected at St. Petersburg toward the latter part of the year, under State control, for the construction of military automobiles and the different accessories, which up to the present had to be imported from other countries, especially from France. The British army called upon the Automobile Club to furnish several machines for this year's maneuvers, and the call was responded to by a number of volunteers, among whom were Mr. Mark Mayhew, with a light 7-horse power Panhard & Levassor machine; J. Hargreaves, with a 12-horse power Daimler, and Mr. Holder, with a 16-horse power Napier. These machines were placed at the disposition of General Buller for the whole duration of the maneuvers, which commenced on the 22d of July. The Self-Propelled Traffic Association also furnished a number of machines to Capt. Lloyd, Secretary of Transports at the War Office, among which were a quadricycle of the Ariel type and three steam tractors made by Thornycroft & Milnes. A novel type of military automobile is shortly to be tried upon one of the Italian railroads. It is heavily armored, and is designed to protect the railroads in time of war. It will transport an officer and two soldiers. The motor is of the gasoline type, single cylinder, and gives 7-horse power at 2,000 revolutions per minute. Bessemer steel is used for the armor plating and it is expected to carry Maxim guns. The total weight of this machine is 3,100 pounds. It will be used especially as an advance-guard for the trains, to explore the way.

The British War Office proposes to carry out a series of elaborate experiments by the artillery with the acoustic telemeter. The object of this contrivance is to locate the position of guns and rifles, which cannot be otherwise located owing to the invisibility of their discharge. The apparatus is the invention of General Gilletta, of the Italian army. The instrument denotes the direction from which the hostile firing is proceeding, and also records the distance at which the firing occurs. The instrument will also be subjected to a series of severe tests in the forthcoming Italian military maneuvers, a number of instruments having been specially constructed for this purpose.

Electrical Notes.

Work has begun on the electric railroad between Halle and Merseburg, the construction of which has been authorized by the Prussian government. The total length will be 10 miles. Power will be obtained from the River Salle.

The horse-car lines of New York exceed in length those of the rest of the cities of the United States combined. It is to be hoped in time that all of these feeders to more important lines will become converted to some electrical system.

The report of a committee to the Franklin Institute on the use of granite as an insulator for electrical purposes has been published. Granite chips are calcined and powdered feldspar and kaolin added with water to make a plastic mixture, and the molded objects heated to 3,000 deg. F. and glazed. The product absorbed 0.76 per cent of water in a year. It crushed at 7,000 pounds per square inch; showed a tensile strength 900 pounds per square inch; and a sample of a size not stated had an insulation resistance of 8 megohms.

From information published in the Oesterreichisches Handels-Journal, the Vienna-Pressburg line is to be constructed within the very near future, for the preliminary work is completed, and the representatives of the government are at present arranging the final details, regarding the use of the bridge across the Danube and the work to be done at the Hungarian end of the line, with Messrs. Siemens & Halske, who have obtained the contract, according to which the line is to be completed by March next year, and trains are to run at intervals of one hour.

The Central London Railroad's latest electric locomotive introduced to reduce vibration to a minimum is provided with lighter armatures than those previously employed. They run at triple the speed of the former engines, while gearing is used to reduce speed to the requirements of the drivers. The company also propose to experiment with the multiple unit system. For this purpose the trains will consist of two motor coaches, with four trailers, and although the total weight of the train will be only 96 tons, as compared with the 126 tons' weight of those at present in service, the seating capacity will be the same.

The capabilities of electricity as a motive force for automobiles was recently satisfactorily established by the accomplishment of a run from London to Reading and back, a distance of 94¾ miles, on one battery charge. The distance was covered in eight hours. The battery utilized was of the Leitner type, devised about one year ago for this purpose by Mr. Harry Leitner. This record was only one of a number of remarkable runs that were undertaken to prove the efficiency of the battery. On other occasions the car accomplished 70, 80 and 85 miles on one charge. During the course of the trials a total of 1,837 miles was covered by this one car, the units consumed for the purpose amounting to 954.8, and the cost on the average amounted to about three cents per mile. The car on every occasion carried four, and sometimes five, passengers.

Consul Mahin, of Reichenberg, reports that an electric street railway company has been formed at Carlsbad, and negotiations with supply and construction firms are invited. Carlsbad is as yet devoid of any kind of public conveyance, except cabs and hotel omnibuses, though it has a permanent population of 15,000, to which are added between April and October of every year 40,000 or more sojourners. The city is spread out, along the Tepl River, a distance of several miles, from the railway station to the Posthof, between which points street car communication would prove a great boon to the permanent and sojourning population. Branch lines on side streets leading to the villas and hotels on the adjacent heights would also be practicable. Communications addressed to the Elektrische Strassenbahngesellschaft, Carlsbad, Bohemia, would reach the promoters of this project.

The Municipal Council of Guyaquil has recently granted to a syndicate a charter authorizing the construction of an electrical tramway system in that city of some 50,000 inhabitants. The charter permits the use of any of the streets of the city, and provides for the construction of a new race course, including a bicycle track, in the suburbs of the town. It also grants the use of electricity for lighting and power. The concession runs for thirty-five years, at the end of which time the tram and race course will revert to the city without compensation. At present Guayaquil has a very poor mule-car system, despite which dividends have been superb—25 per cent annually for a number of years past. The principal streets of the city are lit by gas of an inferior quality—some sections by kerosene lamps. The mule-car system will probably be bought out and absorbed by the new company, which is now seeking capital in the United States. The matter is worth the attention of those interested in this line of business.

Engineering Notes.

Steel sleepers will be manufactured near St. Petersburg for Russian railroads.

Experiments with acetylene for lighthouse use have been carried out at Genoa. The acetylene light was seen at a distance of 40 nautical miles from Genoa.

The weight of electrical machinery in proportion to its output has been studied by Herr Seefehlner. The result of his observations, which he has collected from eighteen different sources, tends to show that up to a certain size the weight of materials per unit of power decreases rapidly with increasing capacity, but for higher capacities the weight per unit of power is very nearly constant.

A French syndicate has been formed for the purpose of mining iron and coal in the vicinity of Dover, England. Extensive mining rights have been acquired in the Alkham Valley, in the south of Kent, and not far distant from Dover. The boring is to be undertaken by French laborers under the supervision of skilled engineers from the Pas de Calais. A new American diamond drill is being erected for the work. Kent is very rich in iron ore, and at one time was the principal iron-producing district in England. At various parts of the country may be seen closed iron mines. The reason for their abandonment was the scarcity of coal, but at Dover and at other places rich seams of coal have been discovered beneath the iron ore strata, so that there is every possibility of the iron-mining industry in this part of England being revived.

The Egyptian government has granted concessions to an English firm for the mining of turquoises in the Sinai Peninsula. It is not proposed to open any new mines at present, but simply to rework the abandoned mines at Maghara and Sarakan. From the hieroglyphics upon the rocks in the district it appears that the ancient Egyptians originally opened these mines, and until recently they were worked in a spasmodic manner by the Bedouin Arabs. The English company proposes to install a modern mining plant and to engage Bedouin labor. This peninsula is now the only district in the world from which turquoises of the finest water may be obtained. The Persian mines, which have hitherto supplied the world's market in this direction, are rapidly becoming exhausted, but this peninsula is peculiarly rich in these stones.

A new method of burning liquid fuel has been devised by Messrs. Muirhead & Coy, a firm of electrical engineers of Beckenham, London. It is called the hydroleum system, and by means of it all descriptions of liquid hydrocarbons from petroleum to the various tars and tar refuse are consumed with an entire absence of smell and smoke. The burner comprises a combined feed of steam and oil, or refuse, and the vapor of these two is concentrated upon an incandescent fire brick, upon striking which the combined steam, by means of the intense heat, is divided into oxygen and hydrogen, and these combining with the carbon are ignited and passed through the boiler. So perfect is the combustion, and so intense is the heat that is generated, that a considerable economy is effected in the consumption of the fuel for boilers of every description. Tests with a 50 horse power Hornsby boiler have shown that 15 pounds of water are evaporated by the consumption of 1 pound of tar refuse, whereas with the same quantity of steam coal only 9 pounds of water are evaporated. The Admiralty have examined the process and intend to experiment with it in the navy.

M. Raoul Pictet, the famous Swiss inventor and chemist, has effected a remarkable discovery concerning the manufacture of oxygen upon an extensive scale for commercial purposes. The inventor has been engaged for three years upon this invention at his laboratory in Geneva, where he is a professor of chemistry and physics. When the process was satisfactorily perfected to permit of experiments being conducted he went to Paris and was persuaded to visit Dr. Dreyfus, the celebrated chemical expert, of Manchester, England. When the inventor had laid the scope of his idea before Dr. Dreyfus the latter, realizing its tremendous possibilities, sought the assistance of several experts in the steel and chemical industries, and arrangements were then advanced for experimenting upon an elaborate scale with the invention. For this purpose an extensive plant has been erected at the works of Messrs. Galloway, the famous Manchester boiler makers. The invention consists in obtaining oxygen from the atmosphere by physical means and not by the chemical process at present in vogue; but the process is so simple that it will not cost more than one cent to obtain two cubic feet of oxygen. It will be applied to the metal and chemical trades, lighting, and public health. The oxygen will be mixed with water gas, and a much more brilliant illuminant will be obtained at a much cheaper price. It possesses great heating properties, and for this purpose will be peculiarly adapted for smelting various mineral ores.

FOSTER'S FOG SIGNALS.

The problem of safety from collision at sea has rightly been divided into three parts: First, to prevent the collision; second, to save the ship in case of collision; third, in case the ship must be abandoned, to save the passengers and crew. Foster's system of fog-signaling aims to reach the root of the matter by preventing the collision, and so to make provision for the second and third parts of the problem unnecessary. This is accomplished by means of a signaling apparatus which not only warns approaching vessels that they are in close proximity, but enables each to tell the other its exact compass bearing from the other, and also the course it is steering. The same apparatus can be used for communicating by the Morse code during fogs.

FALKNER ISLAND, LONG ISLAND SOUND, SHOWING FOG-SIGNAL STATION.

The great difficulty with sound signals, as distinguished from light signals, is that they cannot be located with accuracy. If the fog signals were as easily located as the lights, navigation would be as simple in thick weather as it is at night.

The Hamilton-Foster system of fog-signaling is designed to overcome this difficulty by making the sounds of such a character that they shall announce with certainty to any person within hearing distance the exact direction from which the warning sounds come.

This is accomplished by the use of a sound director or megaphone, which concentrates and projects various signals first in one direction and then in another, combined with an apparatus for varying the signal according to the direction to which it is sent. Any passing vessel must hear one of these sounds more clearly than the others, and the signal which it hears most distinctly tells it the exact direction from which the sound comes.

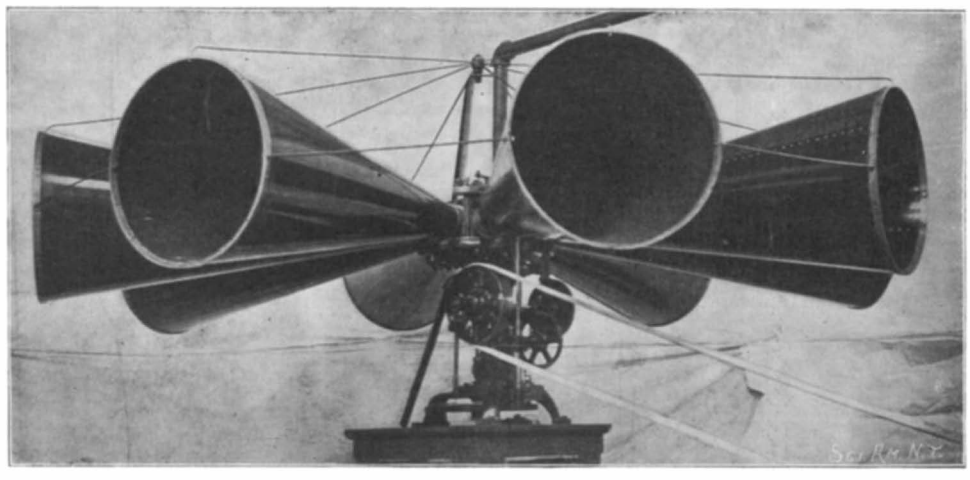
Experiments made by the Lighthouse Board of the United States have shown that when a vessel is opposite one of the megaphones the sound sent out by that megaphone is overpoweringly greater than the sound from any of the others, and that at a distance of more than a mile it is impossible to hear any of the sounds except those sent by the megaphone which is pointed directly toward the listener.

The apparatus is in the form of a single automatically revolving megaphone, which turns to each of the eight points of the compass in turn, west, northwest, north, etc., and gives a signal for each point by means of a simple code of long and short blasts.

All the signals which signify the general direction of west begin with the short blast, while all those signifying the general direction of east begin with a long blast. Opposite points have opposite signals, east, for instance, being one long and one short, while west is one short and one long, so that if you learn half the code you know the other half.

The full code is as follows: One long blast, the signal you hear is north of you; one short blast, it is south of you. Two long blasts, signal is northeast; two short blasts, it is southwest. One long and one short, it is east; one short and one long, it is west. One long and two short, it is southeast; two short and one long, it is northwest. When the apparatus is placed upon moving vessels for the purpose of avoiding collisions it is so constructed that the megaphone can be easily turned, so as to give the proper signals no matter how much or how often the vessel changes its course. To accomplish this, a pointer on a dial representing a compass is shifted so as to agree with the course steered. If the vessel's course is W. S. W., for instance, the pointer is simply put on that mark on the dial.

As the vessel proceeds upon her course she blows her signals automatically, giving any other vessel which may be in the neighborhood exact information as to her position. As the revolving megaphone in its circuit points toward the bow of the vessel upon which it is placed, it blows a supplementary signal of different character, such as the whistle of the smokestack which shows that the megaphone is then pointing directly toward the course which the vessel is steering. If this course signal immediately precedes or follows a compass signal, it gives the vessel's course. If the megaphone signals "east," and the whistle immediately follows, showing that the megaphone is pointed over the bow, the vessel must be east of you, and its course must be a little north of west.



HAMILTON-FOSTER FOG SIGNAL WITH FIVE-FOOT MEGAPHONES.

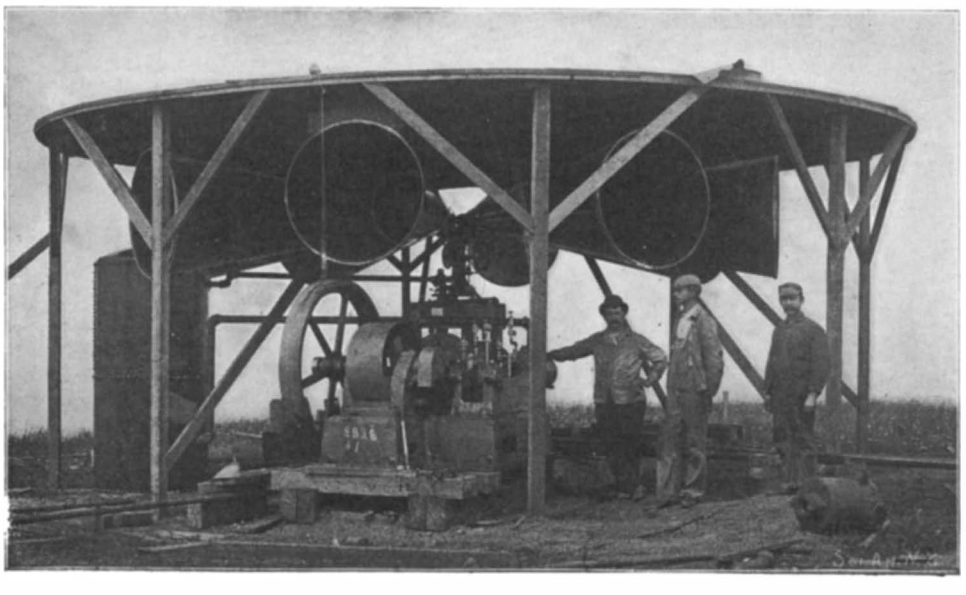
Men-of-war use this apparatus to enable the vessels of a squadron to maintain an exact position with relation to one another on the darkest night, without having to show a light of any kind. During blockades a vessel could indicate its position to the commodore at night, and the signals would be quite inaudible on shore, as the megaphone would not be pointed that way. In foggy weather a fleet could proceed in regular order, each vessel in line advising the next one of its exact position.

A very simple attachment to the signaling apparatus enables vessels to communicate with one another by the Morse code, but the messages sent are inaudible to any vessel but the one toward which the megaphone is directed, so that men-of-war might send messages which could not be heard by an enemy.

When placed upon a lighthouse, this apparatus is particularly useful to small boats that may be caught in a fog without a compass, because, if the sailor knows the course he should steer *from* the lighthouse, he can get into the range of the proper signal and keep in it until he arrives at his destination. With the present system of signaling it is a common thing for a small boat without a compass to be aware that there is a fog signal blowing on the port hand, for instance, but quite impossible for the sailor to tell whether he is on the north, south, east or west side of that signal; therefore, he has not the slightest idea of which direction he ought to take in order to reach port.

This apparatus was erected at Falkner's Island, on Long Island Sound, and thoroughly tested by a special committee appointed by the Lighthouse Board at Washington. The report of the committee was so favorable that the United States government immediately purchased the apparatus as it stood, and asked Congress for an appropriation for the erection of similar fog signals at other points.

The Canadian government have also purchased the apparatus, and are erecting a signaling station at Fame Point, in the Gulf of St. Lawrence.



FOG SIGNAL PLANT, FALKNER ISLAND.

Tycho Brahe's Tomb Opened.

On the occasion of the three hundredth anniversary of Tycho Brahe's death the Prague Town Council decided to gather together the remains of the celebrated astronomer, which were in the Teyn Church, and bury them anew. Under the guidance of Mr. Herlein this operation was begun. After having lifted the stone block on the monument, which is situated near the first column in the nave, and which bears a full-length effigy of the great astronomer, a semi-collapsed arch was found, and on removing the stones two mouldering coffins were seen. On the following day a committee met to determine whether these bodies were those of Tycho Brahe and his wife. Two workmen with candles descended into the vault and removed the débris which covered the coffins, the wood of which was quite rotten and fell to pieces at every rough touch. About 10 A. M., the lid of the first coffin was free to be removed. It was a surprising sight that met the eye; the body in the coffin was a wonderful likeness of the effigy on the monument. The head was slightly turned to one side, the bones of the face and the peaked Spanish beard being well preserved. The head was covered with a skull cap, and the neck was surrounded by a Spanish ruff, which, like the remainder of the clothing, had suffered little during the three hundred years since Tycho Brahe was laid in his last resting-place. The feet were shod in long cavalry boots reaching up over the knee. That the body was Tycho Brahe's was also seen from the absence of the nose. Tycho lost this organ in a duel, and wore a silver one in its place. Among the rubbish was found a silver wreath and spray of flowers. The construction of the grave was rather remarkable, the stones being laid loosely over one another. This is all the more astonishing, seeing Tycho Brahe was buried with great pomp and honors; but it is supposed that the vault broke down during the restoration of the church in 1721.

The Fire Department of New York city has great difficulty in keeping the fire alarm telegraph system in order owing to the rapid transit operations. The inspectors recently reported that more than three hundred fire boxes were out of order. Temporary repairs were made, and the wires are now in working order. It is needless to say that the city was in great danger during the time these wires were out of order.

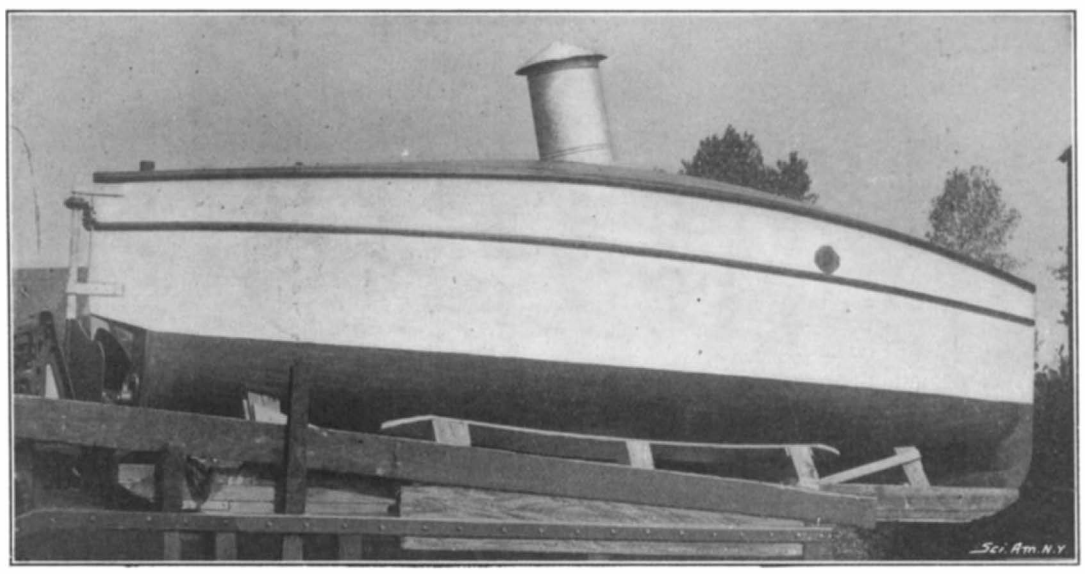
FOOLHARDY ATTEMPTS AT PASSING THE WHIRLPOOL RAPIDS OF NIAGARA.

BY ORRIN E. DUNLAP.

On July 9, 1900, Peter Nissen, of Chicago, made a trip through the whirlpool rapids of Niagara in a boat of his own construction. On Nissen's return home he conceived the idea of rebuilding his boat in order that he might take a series of soundings close to the falls and also in the whirlpool. On this new craft he expended much time and labor, and at this writing it is at Niagara Falls in readiness for another trip, which is scheduled to take place while we are on the press. Before approaching the whirlpool Mr. Nissen will investigate the mysteries of the waters in the gorge between the falls and the rapids, and he hopes to be able to obtain data in regard to the river bottom that will be valuable in connection with this strange river, which has always commanded the attention of geologists and scientists. It is Mr. Nissen's idea that in his craft he can approach very close to the sheet of falling water and there take soundings that will tell to what extent the great downpour of water is affecting the bottom of the river. He expects to go much closer than any human being has yet approached the great Horseshoe, and at the point where it breaks over the shelving precipice, he hopes to sound the bottom.

The length of Mr. Nissen's boat is 21 feet, while it has an outside beam of 4 feet and a height of 6 feet 6 inches. The present boat is claimed to be the smallest full-decked steamer in the world. In shape it somewhat resembles a whaleback. The wood used in the construction of the boat is oak, elm and pine. The deck is of oak and pine. The total weight of the boat is between four and five tons. The wooden keel has an iron weight or additional keel attached which weighs about 2,100 pounds, as compared with the iron keel of 1,250 pounds of last year's boat. The only part of the old boat that shows in the new boat is the sternpost. Eleven new ribs have been added, and new parts substituted for old parts.

At the port of Chicago the boat is registered as the "Fool-Killer," a pleasure launch, and Nissen by the papers is allowed to carry two people, which includes the crew. Amidships the new boat is a foot higher than the boat of last year, but it is of the same height at the stem and stern. It draws nearly four feet of water. It is painted red at the bottom to the water line, and white above that point, two streaks of natural oak being on each side near the top and about a foot apart. Examining the boat from the exterior one sees two deadlights, or windows, set about eight feet back from the stem, one on each side of the engine room. The glasses are about 4 inches in diameter and of heavy plate, affording ample light to look about the engine room. They are set about 10 inches below the deck. The



THE "FOOL-KILLER II.," BUILT TO NAVIGATE THE WHIRLPOOL RAPIDS OF NIAGARA—THE SMALLEST FULL-DECKED STEAMER IN THE WORLD.

rudder of the boat is of wrought iron, and has two heavy wrought iron hinges that are bolted through the sternpost. The cross-section of the steel heel-plate is 1¼ inches by 5 inches. It forms an extension of the keel. The lower end of the rudder runs through this heel plate.

The propeller is four-bladed and 28 inches in diameter, quite large enough for a 40-foot boat. It is a high-speed wheel with an unusually short pitch. It will be recalled that when Nissen's boat passed out of the whirlpool last year it lost the rudder, propeller and iron keel before it reached Lewiston. Nissen's trip of last year was finished at the whirlpool, the boat being next day sent on to Lewiston. The injury received was from rocks near the Devil's Hole.

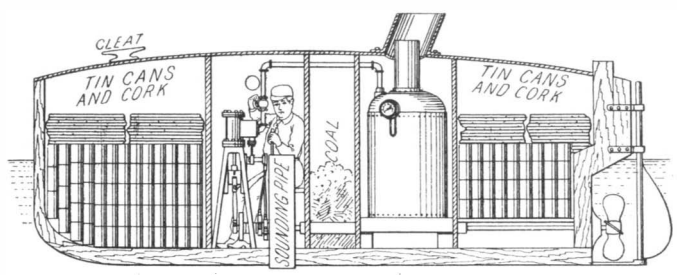
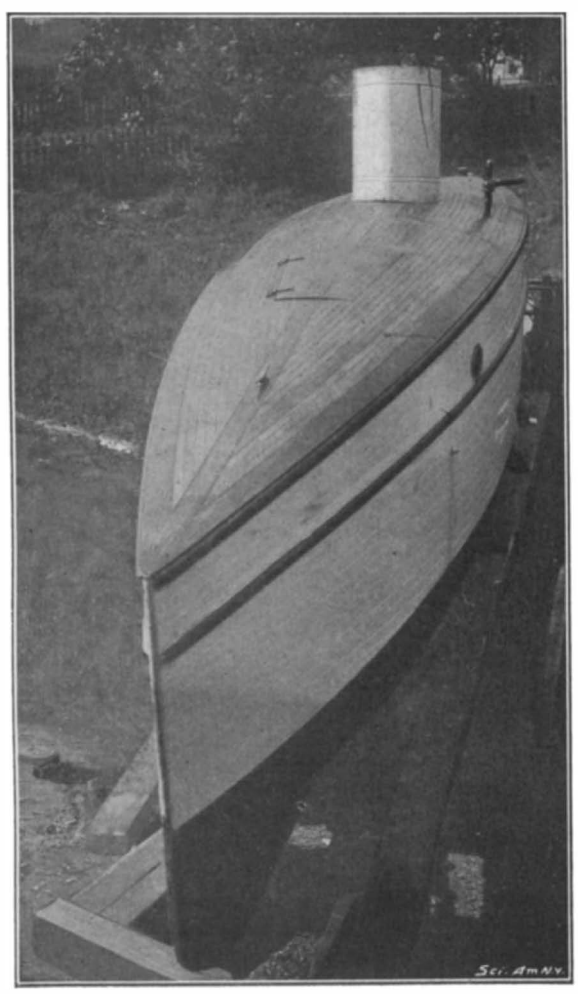


DIAGRAM SHOWING ARRANGEMENT OF THE "FOOL-KILLER II."

The interior of the boat is divided into five spaces, one at either end for corks and cans, an engine room, a coal room and a boiler room. Separating these compartments are bulkheads, four in number, but not water tight. The first of these bulkheads is forward of the engine room; the second in the rear of the engine room, and bulkheads fore and aft of the boiler room. The bulkheads are made of 3-inch pine.

The engine installed is a common slide valve, link motion, made for marine purposes and of about 8 horse power. It is connected to the propeller by a shaft 1¾ inches in diameter. The engine is located forward of the boiler, and this shaft extends under the boiler through an iron pipe that runs through a tunnel. The engine room measures 3 feet by 3 feet. Between the engine room and the boiler room there is a space 15 inches wide by the width of the boat for coal, tools, etc. The boiler installed is of the porcupine tubular type and of 8 horse power. There are two injectors and a hand pump for supplying water to the boiler, while the necessary gages, water column and gage cocks, together with a steam siphon, having a capacity of about 500 gallons an hour, for emptying the boat, are in place.

The sections of the boat forward of the engine room and aft of the boiler room are filled with tin cans and cork to support the boat in case of springing a leak. It is understood that the craft has been tested and it was found that it is impossible to sink the boat even though it is full of water. In running the boat Nissen occupies a bench on the starboard side of the engine. Facilities for making soundings are afforded by a sounding pipe 4 inches inside diameter extending from a point above the water line in the engine room through the bottom of the boat. Over the engine room there is a hatch that can be left open in quiet water, and closed in rough water. Last year in his trip through the whirlpool rapids, and for an hour when he was in the whirlpool, Nissen occupied an open cockpit, but this year it will be possible for him to be wholly covered.



BOW VIEW OF NISSEN'S "FOOL-KILLER II."

MISS WILLARD'S FATAL TRIP IN A BARREL.

So far as known, the first craft to pass through the whirlpool rapids of Niagara with human beings aboard was the small steamer "Maid of the Mist" on June 6, 1861. There were three men on board this boat, the principal one being Joel Robinson, who won renown by the daring feat. From that time until 1883 no person braved the billows of the wonderful gorge. In 1883, however, Capt. Matthew Webb, an English swimmer of note, crossed the ocean and journeyed to Niagara, bent on swimming through the rapids. He attempted the feat on July 24, 1883, and lost his life.

The death of Webb had a stimulating effect on people who love notoriety, and at once a number of schemes for navigating the rapids presented themselves, or were presented by people who sought fame and dollars. One such was Carlisle D. Graham, a Philadelphia cooper, who announced that he would build a barrel in which he could navigate the rapids and whirlpool. There was some little laughter at the thought of a human being rushing through the turbulent waters of the Niagara gorge inclosed in a barrel, but all the jokes cracked did not deter Graham from carrying out his scheme, and on the afternoon of Sunday, July 11, 1886, Graham surprised everybody by not only going through the rapids and whirlpool, but he went down to Lewiston, the full length of the gorge. Since that time he has made four other rapids trips in his barrel. One of these was made on July 13 last, when he landed at the whirlpool.

One of the results of Graham's last barrel trip was to arouse the ambition of Miss Maud Willard to make a similar trip, the result being that Graham and Miss Willard agreed to navigate the gorge on Saturday, September 7. The plan was to have Miss

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C. D. GRAHAM, WHO MADE A NOTABLE SWIMMING RECORD DOWN THE NIAGARA RIVER, AND MISS WILLARD, WHO LOST HER LIFE IN THE WHIRLPOOL RAPIDS.

Willard make the rapids voyage in Graham's barrel, while Graham, protected by a life preserver, was to swim from the whirlpool to Lewiston, a feat never successfully performed up to that time.

On the afternoon referred to Miss Willard and the barrel were cast adrift above the lower bridges at 3:58 o'clock. Two minutes later she passed under the bridges, and at 4:04 P. M. the barrel entered the whirlpool. It had been the experience that barrels and boats were captured and withdrawn from the pool within an hour after entering there, but in Miss Willard's case the barrel was not caught until after 9 P. M., and she had been floating in the pool over five hours. When she entered the barrel she took her pet dog for company's sake. When the barrel was landed the dog was alive, but Miss Willard was dead. She is the first woman to lose her life in navigating the whirlpool rapids of Niagara. The day before Miss Willard's trip, Martha Wagenfluhrer made the trip and was taken from the pool alive. Miss Wagenfluhrer is the only woman who ever went through the whirlpool rapids alone. On November 28, 1886, Sadie Allen made the trip in a barrel of different construction with George Hazlett.

While Miss Willard was still floating in the pool, Carlisle D. Graham, in order to accommodate a moving picture machine present that day, left the pool and swam to Lewiston, making the trip in safety. He was attired as shown in the illustration. Between the whirlpool and Lewiston there is considerable rough water, but Graham passed the breakers in safety. Returning to the whirlpool after going to Lewiston, Graham made ineffectual efforts to rescue Miss Willard's barrel, and in doing so was frightfully battered and pounded by driftwood in the pool.

A DESTRUCTIVE BOLT OF LIGHTNING.

How erratic and how destructive lightning may often be was brought home to the cottagers who live in the vicinity of Saratoga in a way they will not readily forget. During a recent storm a dwelling was struck with effects that are vividly told by the photographs herewith reproduced. The lightning first struck the chimney, passed down into a bed chamber, wrecked the bed and turned it over, twisted a picture completely around so that it faced the wall, and finally broke through the side of the house, leaving a large gap. Fortunately the bed was unoccupied during the night of the storm.

The wall and ceiling of the parlor beneath the bed chamber were also badly damaged. A piano suffered considerably, and a violin, on top of the piano, was hurled across the room and broken. Many panes of glass were shattered. Strange to relate, a clock and hanging lamp almost directly in the path of the bolt were uninjured.

EFFECTS OF LIGHTNING, SHOWING WHERE THE BOLT ENTERED AT THE ROOF AND WHERE IT LEFT THE HOUSE AT THE SIDE.

THE INTERIOR OF A ROOM WRECKED BY LIGHTNING.

Balloon Ascension.

In a balloon ascension made on the 31st of July at Berlin, Messrs. Bersen and Suring, two German physicists, reached a height of 31,800 feet. The balloon had a capacity of 272,000 cubic feet, but only received 204,000 feet of pure hydrogen gas prepared by the electrolytic process at the Tempelhof aerostatic park. The hydrogen for filling the balloons is contained in steel tubes having a volume of 350 gallons each, in which the gas is under a pressure of 100 atmospheres. The balloon rose rapidly and at an altitude of 4,600 feet passed a cloud-bank of 1,000 feet thickness which did not hide the whole of the earth's surface from view, as they were able to see distinctly the river Spree as far as Niggel, and the Havel as far as Brandenburg. There were no more clouds up to a height of 30,000 feet, and at this point they were on a level with a second cloud-bank whose thickness could not be estimated. The aeronauts were protected against the cold by a special apparatus called "thermophore," the details of which have not yet been made public. The voyagers employed inhalations of pure oxygen, which protected them against the effects of the rarefaction of the air up to a certain point. It was only at a height of 27,000 feet that they began to suffer from the rarefaction, and this effect increased as they rose. At 31,000 feet the two aeronauts both became unconscious at about the same time, but previously to this M. Bersen had taken the precaution to open the escape-valve, so that after mounting to 31,800 feet the balloon began to descend. The aeronauts remained unconscious for 30 to 45 minutes, but they became quite restored upon reaching a lower level, and experienced no bad effects. It is probable that this unconsciousness was caused by the lowering of the barometric pressure. The minimum temperature reached during the ascension was only —40 deg. C., which is less than was expected. The relatively high temperature at these altitudes is a fact which has been observed at different times in the tests made with sounding balloons. These have been sent up as high as 45,000 to 55,000 feet and have nowhere registered below —70 deg. Further study will be necessary in order to elucidate this question.

The Wastage of Shipping.

The tonnage launched in three months in the United Kingdom totaled 398,585 tons, the measurement of 177 vessels, and now an official report records the waste of shipping as 224 vessels of 171,996 tons, so that the tonnage added to credit is more than double that shown on the debit side. Moreover, while 392,864 tons of the new ships were steam-propelled, only 91,781 tons of the waste was in steamers, and thus the carrying efficiency of the new vessels is nearly four times that of the vessels removed from Lloyd's Registry, from which the returns are issued, says the Engineer. Obviously the difference means keener competition. The wastage indicated is much under the average, for the twelve months' total usually is between 780,000 and 850,000 tons, or at the rate of 210,000 tons per quarter, as compared with the 171,996 tons now reported. We have indicated that the loss is fairly equally divided between steamers and sailing vessels; steel vessels account for one third, iron ships accounting for 61,390 tons, and wooden or composite vessels for 52,187 tons. Since few iron or wooden craft have been built for some years, it will be seen that most of the vessels lost were of some antiquity. Wrecks, as usual, accounted for the greater half of the waste—126 vessels, of 85,078 tons, being thus lost—while 28 vessels, of 24,754 tons, were broken up or condemned. Fires claimed 10 vessels, of 18,807 tons, most of them, curiously enough, being sailing ships; 15 vessels were posted "missing," the tonnage of these averaging nearly 1,000. Nineteen vessels, of 10,661 tons, were abandoned at sea. Collisions sent to the bottom 13 vessels, of 10,199 tons, most of them steamers. Eight vessels, of 7,137 tons, foundered, and five vessels, of 1,815 tons, were otherwise lost. It is gratifying to note that only 47 tons out of every 10,000 tons owned by Britain were lost during the quarter, whereas with other notable maritime powers the proportions were: Italy, 216; Norway, 151; Spain, 135; Sweden, 68; United States, 67; France, 64; Russia, 49; and Germany, 36.

Attention to Pipes and Traps a Matter of Hygiene and Economy.

The Brooklyn Daily Eagle gives the following useful advice on household sanitation:

The plumber and the plumber's bill are bugbears in nearly every household, but frequently the visit of the mechanic is made necessary through carelessness or ignorance on the part of the members of the household, and many a dollar might be saved were the mistress of the house to look well to the usage of the pipes and traps. A rag, a bit of string, a burnt match or a strand or two of hair are not of much account in themselves, but they can create havoc where plumbing is concerned, and lay the foundation for a steep bill for repairs to the pipes that would naturally be expected to carry off such little things without any difficulty. But the rag hanging over the bend of the trap may prove instrumental in removing the water seal and thus subject the household to the danger of sewer gas invasion and subsequent disease. A string, if it becomes twisted, will accomplish the same result. Burnt matches are harmless enough unless they chance to get jammed into a crevice where they serve as a magnet for other solid particles and the result is a decaying mass that is dangerous as well as offensive. Hair, however, is calculated to produce the greatest amount of harm. It acts as a sort of strainer, catching and holding all that passes and is especially partial to bits of soap. In addition hair will lodge in the most inconvenient places and catch upon the least roughness inside the pipe, remaining there until by accretion the space is clogged.

Coffee and tea grounds should not be permitted to find their way into a pipe, for if they do not clog it they effect serious injury in a short time through a combination of mechanical and chemical action.

Not the smallest particle of grease should be allowed to go into the pipes, and frying utensils ought to be filled with very hot soda water and allowed to stand for some time before washing. Milky water, unless the pipes are frequently and thoroughly flushed with soda water or lime water, will foul the pipes even if but a small quantity be sent down daily.

Another point to be observed if the housewife would be spared worry is that the scouring grit be left out of the joints when the faucets are scoured. The particles, no matter how fine, quickly injure the screw threads. Care should be taken also in washing sandy vegetables to use a big pan and prevent the sand draining off with the dirty water. Even a spoonful of sand going down a pipe will injure it.

Sinks and closets should be treated to weekly flushing of boiling water with additional flushings of copperas water or chloride of lime solution. Set bowls should receive additional attention in the occasional swabbing out of the waste vent, using a swab of cotton attached to a coarse crochet hook. Bath tub drain vents may be cleaned in the same way.

Despite constant vigilance pipes will wear out and break, faucets will leak and the plumbing in general require overhauling, but much inconvenience and expense may be spared if careful supervision be kept over drain pipes and traps.

The Eiffel Tower of Paris has proved of immense value as a meteorological station. The extreme height of its topmost platform above the surrounding country has enabled some valuable data to be obtained regarding the wind velocity and atmospheric temperature at that altitude. A complete record of observations ever since the opening of the tower, in 1889, has been made. The meteorological instruments are situated on the uppermost platform, and are connected electrically with a station below. Hourly records are by this means obtained. A curious fact has been noticed in connection with these observations. It is impossible to obtain any record of the rainfall at the summit of the tower. The velocity of the wind at that altitude is so great that practically the rain drops travel in a horizontal direction, and thus the rain gages do not receive them. Even in a heavy storm, this peculiarity has been observed. According to the record, the velocity of the wind at the top of the tower is more than three times that at a height of 70 feet above the ground, and the normal velocity exceeds a speed of 18 miles per hour.

A NEW MOTOR CYCLE.

To equip an ordinary cycle with a motor is attended with considerable difficulty. In many instances the vehicle is unnecessarily encumbered and its appearance spoiled. The most perplexing problem has been to place the motor in the most suitable position. In some cases the motor has been mounted inside the frame, while in others it is carried on the front wheel. Neither of these systems can be said to be satisfactory. A motor-bicycle, however, has now been invented by two Englishmen, Messrs. Perks and Birch, which seems to have completely overcome all obstacles.

By referring to our illustrations it will be observed that the motor is embraced by the back wheel. Thus the engine is placed in direct communication with the driving motion of the cycle. The engine is built as stoutly and yet as lightly as possible, and develops a maximum energy of 2 horse power. The total weight of the complete machine is only 110 pounds.

The cycle and motor contain many unique features and improvements. The back wheel, it will be observed, is devoid of the usual spokes. The rim of the wheel is in reality supported by two strong aluminium wheel flanges. Each wheel side, *s*, is made in one piece, and these pieces when firmly bolted together form a rigid structure. Within these two wheel sides the motor is placed, carried as it were on the hub of the back wheel.

Our first illustration, showing the motor in detail, will more comprehensively explain the construction; the motor being exposed—that is, with one of the aluminium wheel sides removed.

The carbureter, *A*, is of special construction, with a capacity of half a gallon of oil, which is sufficient for a run of approximately fifty miles. It is absolutely automatic in its action. It is filled from the top in the usual manner after removing the screw-cap, *B*. It may be as completely filled as an ordinary bottle, and, owing to the peculiarity of its construction, the engine will continue working at full power so long as any petrol remains. At the bottom of the carbureter is a small tap, *C*, by means of which it may be emptied. This not only keeps the bottom of the carbureter clean, but induces vaporization. Another salient characteristic of this carbureter is that it need never be emptied. There is no danger of the petrol's escaping whether the machine be standing in its normal position or lying flat upon its side, and there is no danger of fire from internal causes.

At the back of the carbureter is the atmospheric adjustment, *D*, consisting of a flat strip of metal on a pivot, which acts as an adjustable lever and can be made to cover one of two holes either entirely or partially. Its normal position is vertical, and except in decided changes of atmosphere, requires but little alteration. When the exigencies demand it, however, adjustment must be made until strong and regular explosions are obtained by moving the lever so as to cover more or less the hole nearer to the side of the carbureter—the other hole need never be covered at all. In frosty, damp, or foggy weather it may be found necessary to reduce the air supply, and occasionally to cover this orifice completely. Experience teaches the rider what is required, but owing to the special method of carburetion it will not be found necessary to alter the adjustment during the course of a journey after it has been once set.

The ignition apparatus, like the carbureter, is automatic in its action. It is entirely self-contained within the wheel. There are no batteries, induction coils, or sparking plugs to trouble the rider. The current is generated by means of the small magneto-electric machine, *R*, fixed to a bracket extending from the crank-case and driven by the revolution of the motor-wheel itself. The current is conveyed from the terminal, *T*, on the magneto-machine to a point on the interrupter guide, *U*, just below the ignition-plug, *L*, by means of a short insulated wire, *V*. Although the magneto-machine itself must not be interfered with or detached, it can be bodily removed for cleaning purposes from the bracket to which it is fixed by detaching the nuts underneath. The vertical interrupting gear receives its interruption motion from the revolving cam, *e*, which actuates the small connecting rod, *f*, thereby giving the oscillating motion to the magneto lever, *S*, and also by means of the formation on its reverse side actuates the vertical interrupter, *W*, and breaks its contact within the valve-chamber at the correct moment for ignition. It can be readily ascertained whether the interrupter is making proper contact by observing that the small roller, *k* (at the end of the interrupter gear) which is struck by the thickened part of the revolving cam, *e*, does not touch the face of the thinner portion. It must be clear of this, and to insure this end an S spring is fitted to the bottom coupling of the vertical insulating block, *j*, so as to bring the roller effectively back to the specified position. If it is necessary to clear or to examine the interrupter gear at any time it can be removed without taking the wheel to pieces. The main insulation is shown at *i*, comprising a good thickness of mica which has been proved to be highly effective. As the automatic parts are not liable to become deranged, very little attention is required. The possibilities of short circuit are very remote, and if any such interruptions should occur they may be easily located.

The most salient feature of this motorcycle, however, is the simplicity of the motor-controlling mechanism. Placed on the left side of the handle-bar is a twisting handle connected with a lever, by which all the several movements of the engine are controlled. When mounting the cycle the lever is brought up as close to the handle as possible. The machine is mounted in the conventional manner, and preliminary impetus is given to the velocipede by pedaling. When the machine is well under way by turning the handle slowly the lever is depressed, which action gradually opens the supply valve and admits the gas to the engine. When the lever has reached the maximum depression the engine is working at full power, so that any intermediate position between the two maximum positions produces any range of power and speed that may be desired.

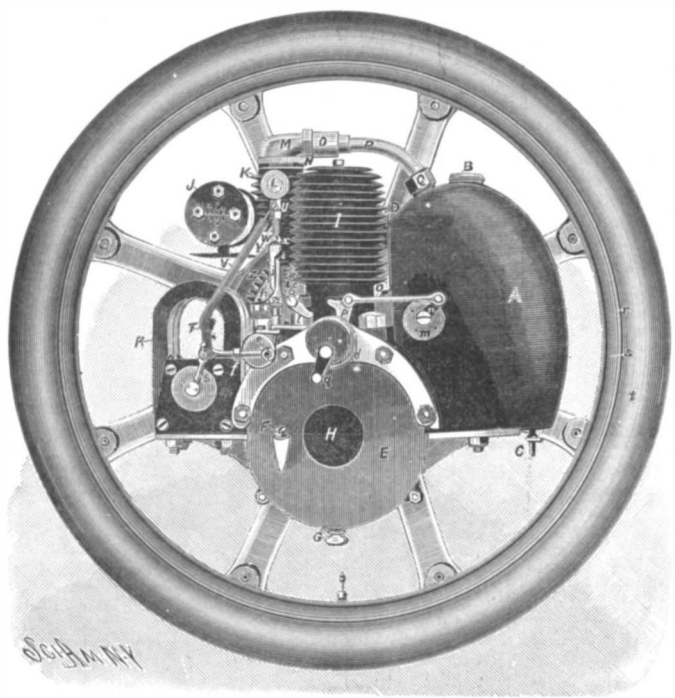

Fig. 1.—INTERIOR OF BACK WHEEL, SHOWING MOTOR.

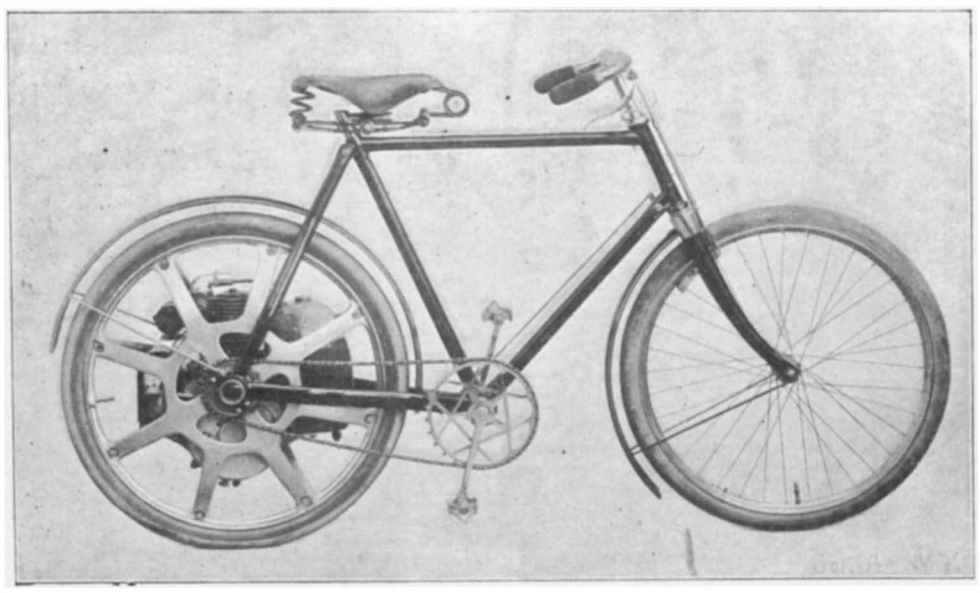

Fig. 2.—A NEW MOTOR CYCLE.

The machine is equipped with a powerful rim brake; and to reduce speed the rider first raises the controlling lever and gradually meanwhile applies the brake, which is actuated from the handle-bar by a lever in the usual way. Care has to be exercised not to apply the brake too suddenly or at any time when the engine is working at full power. The motor frames are built with low brackets, so that when riding over a greasy road or through busy traffic the rider can put either foot to the ground without dismounting.

The machine is supplied with Dunlop tires of the motor type, so that any fear of puncture is remote. Should such an accident occur it can be easily and speedily remedied in the usual manner.

The cycle has been subjected to a series of exacting tests to prove its efficiency and has issued from the ordeals with commendable satisfaction. On one occasion Mr. H. W. Duret, the well-known English automobilist, rode from Coventry to London and back, a total distance of 176 miles, in 18 hours, including stoppages, though the actual time spent in traveling was only 12 hours. It will thus be seen that an average actual traveling speed of about 14½ miles per hour was maintained throughout the journey. The trip was exempt from the slightest accident, and stoppages were made only on one or two occasions for lubricating the mechanism of the cycle.

Strengthening Breakwaters.

An ingenious method of strengthening breakwaters to resist the fury of the equinoctial gales is practised round the coasts of England. Just before the stormy period sets in, huge blocks of masonry are dropped into the sea round the sea ends of the piers and breakwaters, and bonded together with huge sacks of cement. By this means the pier-heads, the most vulnerable points of the structure, are considerably strengthened. To carry out this work a special type of vessel is constructed. At either end of the craft are water-tight compartments, the stern one for the engines, and the fore one for the crew. The rest of the vessel is practically open, and the bottom can be opened or closed at will by huge doors controlled by a lever. Divers first examine the breakwater and signify the points at which it is desirable to strengthen the structure. In the central portion of the vessel is placed a large piece of canvas containing a mixture of cement, beach rubble, and masonry, weighing about 120 tons. The edges of the canvas are drawn together and secured by large stitches. The vessel then steams to the point indicated by the diver, and when over the desired position one of the crew goes to the lever controlling the opening of the doors at the bottom of the vessel, and strikes the pin holding it in position a smart blow. He immediately runs to a place of safety. The huge doors then swing open, and the 120 tons of concrete sink to the bottom. The vessel, thus suddenly lightened, bounces almost out of the water, and when she falls back again a huge column of spray is forced up through the doors to a tremendous height. The doors are then closed, the vessel obtains another load, and the same operation is repeated.

Great Britain Still Leads the Mercantile Marine.

According to Lloyds' Register for 1900 Great Britain still maintains the lead by a considerable majority in the world's mercantile marine. There are 7,930 ships carrying the English flag, while the nearest competitor is Germany, with 1,209 ships. In sailing vessels that country has the lead, with 2,130, as compared with 1,894 of Great Britain, though the aggregate tonnage of the latter exceeds that of that country, neither does the total for England include 1,014 vessels belonging to her colonies. During the year the number of vessels owned in the United Kingdom increased by 3,250,000 tons.

The Current Supplement.

The current SUPPLEMENT, No. 1343, has a number of excellent illustrations and articles. The first page is devoted to the "New 804-Foot Suspension Bridge at Easton, Pa." This bridge is unique in having three towers. The Presidential Address of Joseph W. Swan, F.R.S., at the Glasgow meeting of the British Association, was devoted to the electro-chemical industry. There are two articles on American locomotives abroad. "The Functions of a University," by Prof. W. Ramsay, is a very interesting paper. "Oriental Rug-Weaving" describes curious processes employed in making rugs. The usual Trade Notes and Receipts and Trade Suggestions from United States Consuls are published.

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RECENTLY PATENTED INVENTIONS.

Mechanical Devices.

BALING-PRESS.—Leander Wilson, Alpha, Ill. The baling-press is continuously operated by belt-power, the plunger being worked by toggle arms and gears. The hay or other material is fed in laterally from the top in front of the plunger and packed by an oscillating board worked automatically. Partition boards are introduced behind each bale of hay. The bales are successively forced out one end of the casing between tension devices forming a throat or passageway. The invention is characterized by its compactness, strength, durability, simplicity and power.

STOP-MOTION FOR MECHANICAL TOYS.—Atherton D. Converse, Winchendon, Mass. The inventor has devised a simple mechanism which automatically prevents the wheels of a motor-controlled vehicle from turning when the motor is in force, but the wheels are out of engagement with the support upon which the vehicle travels. The mechanism in question also automatically permits the wheels to turn and the motor to act when the wheels are brought into contact with the surface upon which the vehicle is to move.

THRESHING-MACHINE STRAW-CARRIER.—Herman Baak, Charter Oak, Iowa. The invention is an equalizer for the straw-carrier of threshing-machines. In such machines the reciprocating straw-rack has forwardly-inclined teeth, and on the back movement the straw-rack slides under the straw, while on the forward movement it does all the work of urging the straw forward. The present invention is designed to reinforce the power of the driving-machine of the straw-rack on the forward movement. The strain on the machine is equalized by means of a spring which is put under tension on the back movement of the straw-rack.

MACHINE FOR CUTTING CORN OR THE LIKE.—Franz Nachtigal, Alexandrowsk, Ekatherinoslaw, Russia. The rakes in the automatic agricultural machines are limited in their action and thereby prevent a large useful effect. Further, the iron parts of the rakes are subject to great wear by the rolling motion, not to mention the breakages which so frequently occur. Owing to these defects, Russian farmers use the simple reel-cutting-machine. With the present invention all these disadvantages are removed; for the corn, regardless of its position, can be properly fed to the knives by an improved construction of the reel, and removed from the table or conducted to a binder by a rake driven by simple mechanism.

Metallurgical Appliances.

ORE-SAMPLING MACHINE.—Albert C. Calkins, Los Angeles, Cal. The sampling machine is designed more especially for the use of assayers for rapidly and efficiently mixing and subdividing a quantity of pulverized ore, of which a representative sample may be desired. The machine is also applicable for mixing and sampling or subdividing any kind of material, as frequently required in the drug trade.

AUTOMATIC BLOWPIPE.—Albert C. Calkins, Los Angeles, Cal. The blowpipe is intended for the use of chemists and assayers and is of such construction that it is in a measure automatic or continuous—that is to say, one in which the interval of drawing in the breath is bridged over by the mechanical action of the blowpipe so as to make a continuous blast at the nozzle or twyer end of the blowpipe.

Railway Contrivances.

SWITCH MECHANISM.—Charles F. Gay, Spokane, Wash. The mechanism is designed to operate the switch-tongues of railways from the power-platform and is composed of a shifting-block carried by a car, and a part on the block for engaging between the main rail and the free end of the switch-tongue. A part on the block engages with a projection on the outer side of the main rail to turn the block. A spring returns the parts to normal position.

Vehicles and Their Accessories.

SECURING ELASTIC TIRES TO WHEELS.—William F. Williams, 17 and 18 Great Pulteney Street, Golden Square, London, England. The invention relates to improvements in securing an elastic tire to the wheel-rim by means of a band so applied as to bind the base of the tire or tire-cover to its seat in the grooved wheel-rim; and the improvements have for their object to prevent the cutting of the tire or its cover by the edges of the holding-on band and to prevent creeping of the tire upon the wheel-rim.

CUSHION-TIRE.—Ernest Germain, Boulevard de Strasbourg 2, Paris, France. The inventor has devised a pneumatic tire that can be secured to the wheel-rim without the aid of wires or thickened edges. The pneumatic tire consists of a cushion of soft or spongy rubber in which are formed cells or cavities for the reception of rubber balls inflated with air at a pressure of several atmospheres. The cushion is contained within one or several layers of rubber-coated canvas inclosed in turn by an outer layer of rubber provided with a rubber tread.

HORSE-DETACHER.—Baldomero Valdes Velasco, Key West, Fla. The invention provides a means whereby the driver may release the traces from the shaft or carriage by the pull of the horse on a singletree or doubletree, according as one or two horses are hitched to the carriage or wagon. When a horse starts to run away and the driver can no longer control him, he is simply released, leaving the occupant of the carriage safe.

Blank Books.

LEDGER.—Archibald E. Partridge, Seattle, Wash. The ledger is particularly adapted for use in lodges and fraternal societies. The book is simple and compact. Entries can be made for a number of terms without becoming voluminous; and the labor of entering the names and other personal data of members is materially reduced.

MANIFOLD-BOOK.—Edward D. McKenna, Brooklyn, New York city. In this book copies of bills, letters and orders can be quickly made while the original is being prepared. The invention furthermore provides a carbon-holder of such construction that the carbon sheet and accompanying sheet of silk can be quickly bound together at one of their edges and the holder conveniently placed in the book.

Miscellaneous Inventions.

PORCELAIN-CROWN FACER.—Charles A. Hoffman, New Albany, Ind. The inventor has devised a simple instrument especially adapted for grinding a perfectly flat face upon the cervical portion of what is known among dentists as a "Logan crown," enabling a perfect joint to be ground when setting such a crown upon a root of a tooth.

CROSS-BRIDGE.—Thomas F. Kearney, Brooklyn, New York city. The invention relates to a device for bracing floor-joints and other parallel timbers, such devices being commonly known as "cross-bridges." Mr. Kearney's cross-bridge is formed of two lengths of flat material pivoted at their middles and a spacer arranged between the lengths of material at the pivot to separate them. By pivotally connecting the arms together the bridge can be adjusted to suit the width of timbers to which it is to be applied, and the distance between such timbers. Hence bridges can be made in quantities before their application, since they are readily adjusted to the various arrangements necessary.

BOOK-REST.—William R. Rathvon, Florence, Colo. The book-rest is designed to hold a number of books in convenient position for reading and is specially adapted for use by students so as to hold text and reference books in positions where they may be readily used.

MAIL-BOX.—William H. Walker, Degraff, Ohio. The mail-box is of that type employed for collection and distribution of mail. The object of the present invention is to provide a novel, simple mail-box of this type which is well adapted for the collection and distribution of mail in rural districts, the device being secure, easy to operate, and provided with means for indicating to a person at some distance if there be mail in the box or not.

FISH-TRAP.—Peder M. Benseth, Fairhaven, Wash. The invention is a trap for salmon, having the lead and heart as heretofore but having the pot and the other secondary inclosures of the trap communicating with the side of the trap as contradistinguished from the end, so that the pot and the spiller will bear at right angles to the lead instead of in range therewith. Thus, the secondary inclosure will lie directly in the path of the fish returning against the flood tide and fish will then pass by a natural course into the secondary inclosures of the trap.

GAME APPARATUS.—George C. Felter, Haverstraw, N. Y. Counters are employed in this game, which counters are manually moved on a figured board, according to prescribed rules which may be similar to those for checkers and chess. Special rules have been drawn up by the inventor and a special board devised, so that considerable skill will be required and much amusement afforded.

GATE.—Hill H. Hillerson, Elliott P. O., Ford County, Ill. Mr. Hillerson has devised an improvement in swinging or hinged gates, and has invented an improved means for opening and closing the gate and latching and unlatching the gate when in its opened or closed position.

SHADE-HOLDER FOR CANDLES.—Franklin E. Howard, Buffalo, N. Y. The shade-holder for candles is arranged for convenient attachment to a candle and is readily adjusted to bring the shade in proper position to the candle-flame, thereby securing the desired protection from the rays of the flame.

BEER FILTER AND COOLER.—Leroy A. Weston, Adams, Mass. The beer filter and cooler is to be built in the side wall of an ice-box with only the dispensing faucet and valve projecting outside. The body of the cooler containing the filter is contained within the icebox-chamber to be cooled thereby.

Designs.

DESIGN FOR A SILVERSMITH'S STOCK.—Peter J. Gordon, Manhattan, N. Y. The leading features of the design consist in a scroll and in the representation of floral snowballs, pendent from the scroll.

NOTE.—Copies of any of these patents will be furnished by Munn & Co. for ten cents each. Please state the name of the patentee, title of the invention, and date of this paper.

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WATER WHEELS. Alcott & Co., Mt. Holly, N. J.

Inquiry No. 1386.—For the manufacturers of the Lotrent sliding door hanger.

Yankee Notions. Waterbury Button Co., Waterb'y, Ct.

Inquiry No. 1387.—For dealers in castings for ⅛ or ¼ h. p. gasoline engine for a tandem bicycle.

Gasoline Lamps and Systems. Turner Brass Works, Chicago.

Inquiry No. 1388.—For the manufacturers of a knife with two blades, celluloid handle adapted for inscription under celluloid.

Handle & Spoke Mchy. Ober Mfg. Co., 10 Bell St., Chagrin Falls, O.

Inquiry No. 1389.—For manufacturers or dealers in sheet aluminium.

Sawmill machinery and outfits manufactured by the Lane Mfg. Co., Box 13, Montpelier, Vt.

Inquiry No. 1390.—For manufacturers of machinery for making articles out of aluminium.

For Sheet Brass Stamping and small Castings, write Badger Brass Mfg. Co., Kenosha, Wis.

Inquiry No. 1391.—For manufacturers to make to order miniature objects, such as men, dogs, horses etc., from 2 inches to 2 feet in height. Also for paper dolls.

Rigs that Run. Hydrocarbon system. Write St. Louis Motor Carriage Co., St. Louis, Mo.

Inquiry No. 1392.—For manufacturers of well casings.

Sheet, bar, rod or wire, cut, formed, any shape. Metal Stamping Company, Niagara Falls, N. Y.

Inquiry No. 1393.—For a machine for threshing, hulling and cleaning rice.

Ten days' trial given on Daus' Tip Top Duplicator. Felix Daus Duplicator Co., 5 Hanover St., N. Y. city.

Inquiry No. 1394.—For brick machinery for making pressed brick.

SAWMILLS.—With variable friction feed. Send for Catalogue B. Geo. S. Comstock, Mechanicsburg, Pa.

Inquiry No. 1395.—For an amplifying telephone receiver.

Machinery designed and constructed. Gear cutting. The Garvin Machine Co., 149 Varick, cor. Spring Sts., N. Y.

Inquiry No. 1396.—For brass tubing, such as is used in making pen or pencil holders.

Kester Electric Mf'g Co's, Self-fluxing solder saves labor, strong non-corrosive joints, without acid, Chicago, Ill.

Inquiry No. 1397.—For parties to make pen or pencil holders in quantities to order.

Designers and builders of automatic and special machines of all kinds. Inventions perfected. The W. A. Wilson Machine Company, Rochester, N. Y.

Inquiry No. 1398.—For the manufacturer of The Home Sharpener, an emery wheel attachable to any sewing machine.

INVENTORS, ATTENTION!—Incorporate your companies in South Dakota. Charter fee, $10. Laws most liberal in United States. Address Box 6, Pierre, S. D.

Inquiry No. 1399.—For manufacturers of electric automobile trucks or wagons for carrying not less than 3,000 pounds.

The celebrated "Hornsby-Akroyd" Patent Safety Oil Engine is built by the De La Vergne Refrigerating Machine Company. Foot of East 138th Street, New York.

Inquiry No. 1400.—For machines for making butcher skewers.

The best book for electricians and beginners in electricity is "Experimental Science," by Geo. M. Hopkins. By mail, $4. Munn & Co., publishers, 361 Broadway, N. Y.

Inquiry No. 1401.—For machinery for separating materials in refuse, and afterward grinding and mixing, after which it is pressed into balls, bricks, etc.

ENGINEER.—Wanted by a practical Cornell man a position as assistant superintendent in a good going concern. Would invest capital if arrangements can be made. Address M. B., Box 773, New York.

Inquiry No. 1402.—For manufacturers of electric belts.

☞ Send for new and complete catalogue of Scientific and other Books for sale by Munn & Co., 361 Broadway, New York. Free on application.

Inquiry No. 1403.—For manufacturers of nickel or nickel alloy tubes for gas engines.

SEEN FROM THE CAR WINDOWS.—The route of the Lackawanna Railroad between New York and Buffalo is one of the unusual attractions to lovers of scenery. It passes through the most picturesque portion of Northern New Jersey, through the famous Delaware Water Gap, and climbs the Pocono Mountain, disclosing at every turn beautiful distant views of the mountains and valleys of Eastern Pennsylvania. At Scranton it passes through the coal region, and the scene from the car windows is a revelation of the enormous extent of the coal industries of the vicinity. The entire trip is enlivened by diversified scenery of lakes, mountains, streams and thriving cities. The management of the Lackawanna is leaving nothing undone that can add to the comforts of their patrons.—Official Railway Guide.

Inquiry No. 1404.—For shaping machinery used in making electric light, telephone lighters, railway cross arms and borer for same.

Inquiry No. 1405.—For machinery for making insulating pins.

Inquiry No. 1406.—For dealers in figured wood for veneering purposes.

Inquiry No. 1407.—For launch hulls of steel 13 to 30 feet long to be driven by gasoline motor.

Inquiry No. 1408.—For manufacturers of paper tubes for cigarette making.

Inquiry No. 1409.—For addresses of manufacturers of machinery for the separation and preparation of American asphalt, both sand and rock.

Inquiry No 1410.—For parties to manufacture a portable bootblacking device, consisting of tricycle and stand combined.

Notes & Queries

HINTS TO CORRESPONDENTS.

Names and Address must accompany all letters or no attention will be paid thereto. This is for our information and not for publication.

References to former articles or answers should give date of paper and page or number of question.

Inquiries not answered in reasonable time should be repeated; correspondents will bear in mind that some answers require not a little research, and, though we endeavor to reply to all either by letter or in this department, each must take his turn.

Buyers wishing to purchase any article not advertised in our columns will be furnished with addresses of houses manufacturing or carrying the same.

Special Written Information on matters of personal rather than general interest cannot be expected without remuneration.

Scientific American Supplements referred to may be had at the office. Price 10 cents each.

Books referred to promptly supplied on receipt of price.

Minerals sent for examination should be distinctly marked or labeled.

(8367) H. M. S. asks: 1. In building wired for three-wire system is it possible to install a single dynamo without making radical change in wiring? A. No alterations in wiring are needed. Connect the middle wire to one pole of the dynamo and the two outside wires to the other pole. 2. What horse power gas engine with jackshaft is required to pull dynamo of 25 to 30 16 candle power, 110-volt lamps? A. It would be advisable to have a 5 horse power engine.

(8368) G. M. M.: Referring to Query 8346, A. B. asks: "What is an induction motor?" I would like to ask: What is a short-circuited armature? A. A short-circuited armature is one in which the coils have no connection with the field but return upon themselves. Each coil has its ends connected together. The current which flows in a coil is generated there by induction of the rotating field. The field of an induction motor receives a polyphase current whose impulses are a fraction of a wave length behind each other. This causes a north pole to move around the field from pole-piece to pole-piece like the hand of a clock, for example, passing the hours. A south pole moves also around the field opposite to the north pole. These rotating poles generate in the coils of the armature strong currents which produce a powerful attraction and pull the armature around. This, in the fewest words possible, is the armature of an induction motor, which is in the books called a "short-circuited armature." If the armature were only a disk of iron it would rotate in the same way. It is usual, however, to wind coils upon the iron of the armature as we have described and short-circuit them, hence the name. For a fuller treatment of the subject, see Houston and Kenelly's "Alternating Currents," price $1; or Thompson's "Polyphase Currents," price $5, both by mail.

(8369) D. B. E. says: Will you kindly let me know through "Notes and Queries": 1. Whether acetylene gas can be used in an ordinary gas engine, and if so, what precautions are necessary? A. Acetylene has been used to a small extent in France, more for automobiles than for stationary motors. It has been on trial in the United States, but with what results we do not know, other than that it costs more for a given power than gasoline. It requires no other precaution than is necessary in lighting by acetylene. A smaller quantity than of gasoline vapor is needed for equal effect; its explosive power being greater than gasoline for equal measures of vapor and gas.

(8370) R. W. U. writes: Will you please answer in your paper, why it is so hard to walk to the forward end of a car when the brakes have set hard? A. When the motion of a car is slowing up quickly by the application of the brakes, it causes everything not fixed to the car to have a tendency to slide forward. A person standing or walking in the aisle has his relative momentum with that of the car so disturbed by the difference in motion as between himself and the car that he has a tendency to pitch forward, which breaks his control over his steps, and he finds himself at sea. The trembling motion of the car caused by the irregular slipping of the brakes adds to the nervous disturbance and thus makes walking at such times very difficult.

(8371) R. W. T. writes: In reply to "Notes and Queries" (8296), August 10: My father, who was an officer in the Indian navy and had often been to Bahrein, told me about the water supply there and method of obtaining same. He said that on calm days you could see the action of the submarine spring on the surface of the sea, so I think it could only have been at a depth of about 20 feet. C. P. R. has evidently not considered the difficulty of locating a spring in 200 feet of water. I also remember my father never mentioned that the divers used sinkers to carry them down, as he said was done by the Persian Gulf pearl fishers.

(8372) E. W. I. asks: 1. How many light dynamo will a 1¼-horse power motor run? A. Perhaps a dozen 16 c. p. 2. How many candle-power lamp will a telephone magneto call bell light, which is wound to 10,000 ohms; also will above magneto ignite a gas engine? A. It will not light a lamp, nor do we think it will ignite gas.

TO INVENTORS.

An experience of over fifty years, and the preparation of more than one hundred thousand applications for patents, at home and abroad, enable us to understand the laws and practice on both continents, and to possess unequaled facilities for procuring patents everywhere. A synopsis of the patent laws of the United States and all foreign countries may be had on application, and persons contemplating the securing of patents, either at home or abroad, are invited to write to this office for prices, which are low, in accordance with the times and our extensive facilities for conducting the business. Address MUNN & CO., office Scientific American, 361 Broadway, New York.

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September 17, 1901,

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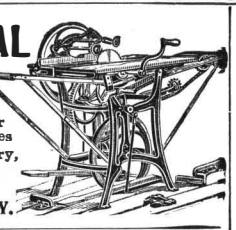

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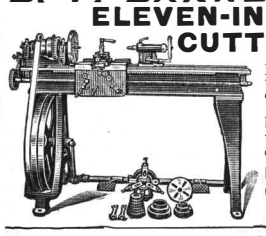

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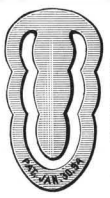

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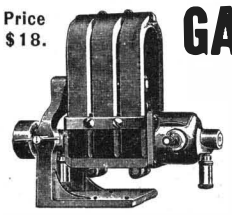

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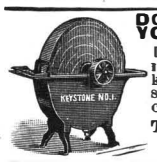

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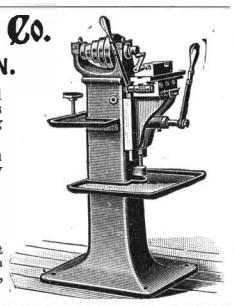

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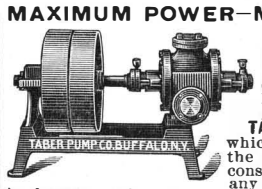

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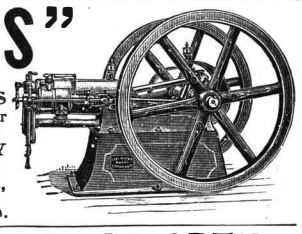

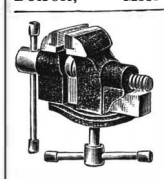

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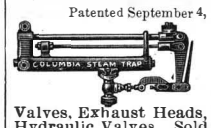

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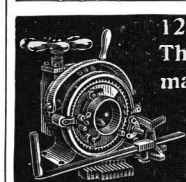

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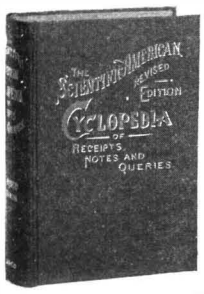

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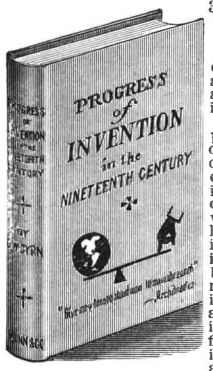

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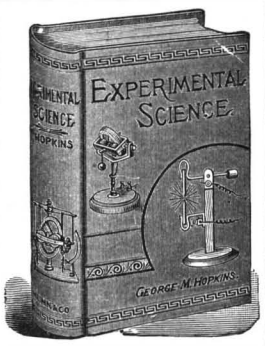

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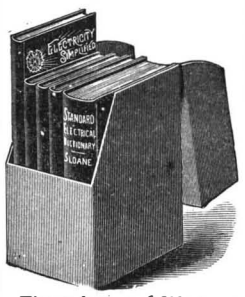

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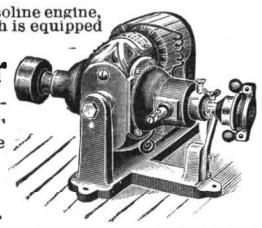

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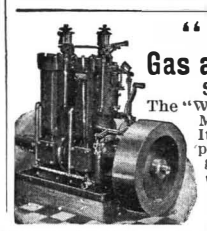

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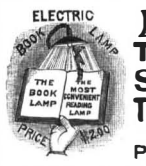

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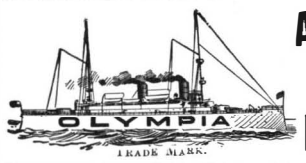

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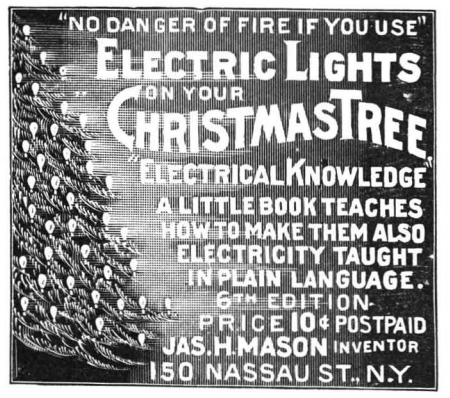

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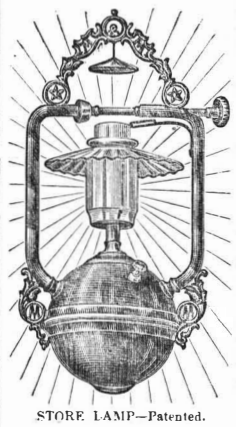
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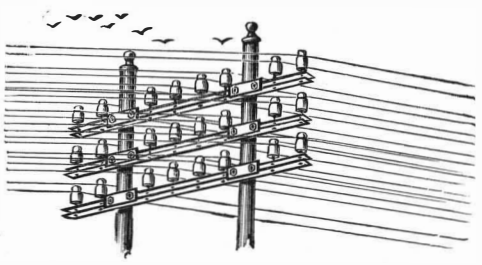
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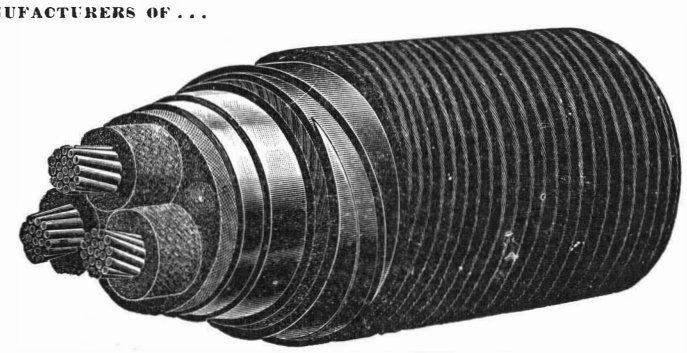
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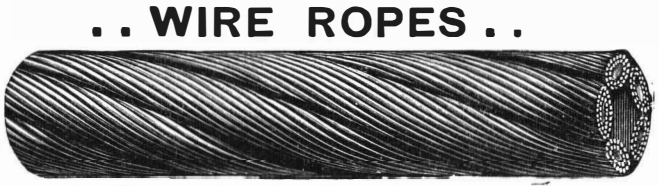
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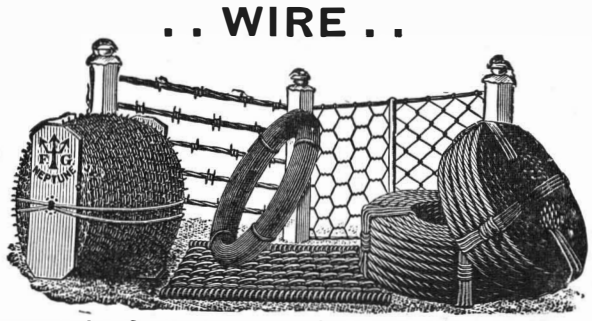
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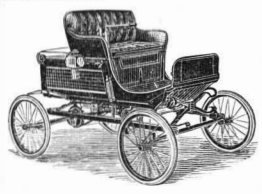

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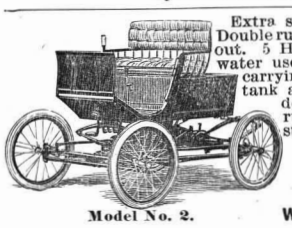

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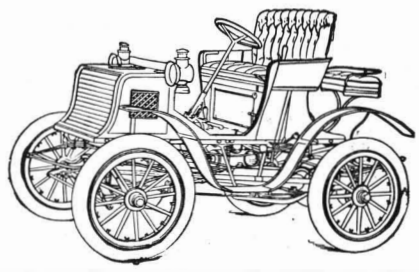

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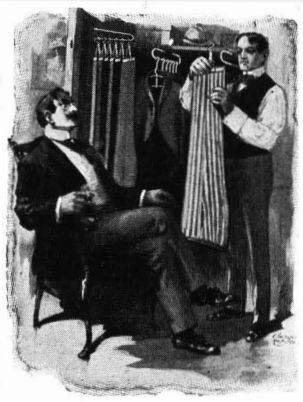

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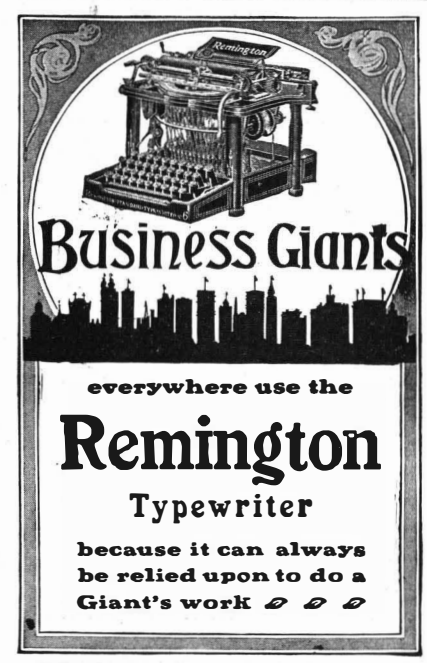

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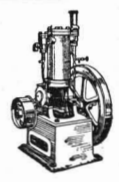

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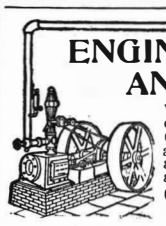

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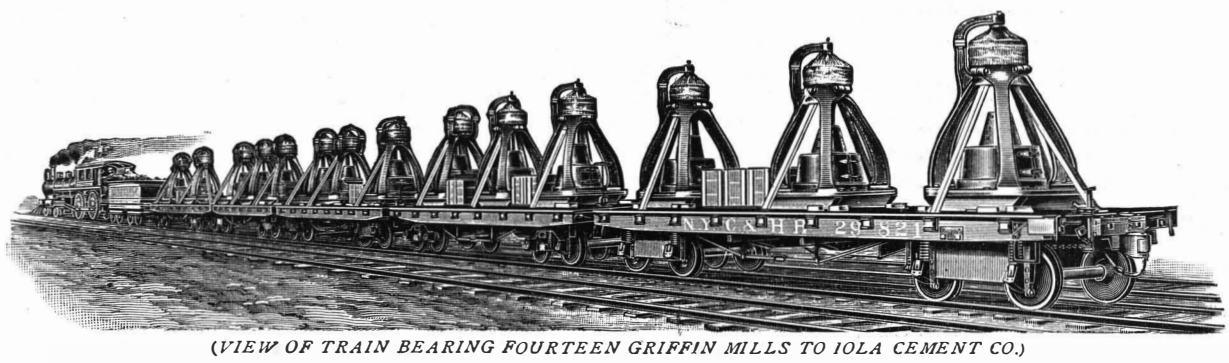

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